

# DEVELOPMENT OF A U. S. COAST GUARD CHEMICAL RESPONSE SUIT

Lieutenant Jeffrey O. Stull



July 1987

Final Report



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of originally selected garmen				
(3) selection and evaluation	of suit mate	rials/components,	and (4) design	n and testing
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#### CHAPTER 1

#### INTRODUCTION AND BACKGROUND

The U. S. Coast Guard is mandated by the Clean Water Act of 1977 (as amended in 1978) and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) to respond to any chemical discharge into the waters of the United States. The Coast Guard also has the responsibility for inspecting and certifying marine chemical-carrying vessels. Finally, the Coast Guard provides assistance to the U. S. Environmental Protection Agency in the supervision of hazardous waste site cleanup and disposal. These missions require appropriate protection for Coast Guard personnel against a multitude of hazardous chemicals, especially those transported in bulk which are likely to be encountered in marine spills and during marine inspections. To aid spill response and monitoring, the Coast Guard developed its own Chemical Hazard Response Information System (CHRIS)<sup>1</sup>, which now defines the properties, hazards, and response techniques for over 1100 chemicals.

As the Coast Guard's role in chemical spill response grew, it found that for many CHRIS chemicals, commercial chemical protective clothing either did not provide adequate protection, or had little chemical data available to judge its performance. As a consequence, a formal research and development project was established in 1978 to develop new chemical protective clothing and equipment that would satisfy Coast Guard requirements. Part of this project was directed toward developing a totally-encapsulating chemical protective suit. The goals of the effort were to:

- (1) select a material or group of materials for incoporation into a "uniform" suit design, which would provide broad protection against as many CHRIS chemicals as possible, and eliminate the need for a large inventory of different chemical protective suits;
- (2) design a suit which would accommodate different types of ancilliary protective equipment (breathing apparatuses, cooling devices, communications systems, and portable air monitors); and
- (3) overcome a lack of performance standards for commercial suits by completely documentating suit capabilities and limitations through thorough laboratory and field testing.

## Barly Work

When the Coast Guard began its research effort, the majority of chemical protective suits available were constructed of butyl rubber with a polycerbonate visor. From these, the Coast Guard selected a suit manufactured by the U. S. Army for chemical warfare applications. This suit was modified for Coast Guard use and became known as the Hazardous Chemical Protective Clothing Outfit (HCPCO). An early Coast Guard study, "Material Development Study for a Hazardous Chemical Protective Clothing Outfit (CG-D-58-80)," identified 400 CHRIS chemicals which required using a totally encapsulating protective garment and self-contained breathing apparatus for adequate

protection. From this same study, measurements of material-chemical permeation indicated that butyl rubber and polyca-bonate were compatible with only 36% and 60% of these chemicals, respectively (for a three hour period).2

Recognizing the limitations of the HCPCO, the Coast Guard undertook the development of its own totally-encapsulating chemical protective ensemble to include the selection of compatible materials and the development of a suit design meeting its specific needs. This effort and the results described below are documented in the Coast Guard Final Report, "Early Development of a Mazardous Chemical Protective Ensemble (CG-D-24-86)". Several existing and state-of-the-art materials were screened by chemical registance and physical property testing. This screening yielded two materials to supplement butyl rubber as garment materials in separate suits—Viton<sup>R</sup>/ chlorobutyl laminate and chlorinated polyethylene (CPE). In addition, a Teflon<sup>R</sup> fluorinated—ethylene propylene (FEP)/Surlyn<sup>R</sup> laminate was chosen to replace polycarbonate as the visor material for all three suit materials.

Each of the selected materials were subjected to extensive chemical resistance testing, including one-sided immersion testing against 160 representative CHRIS chemicals and permeation testing against 59 of those chemicals. The immersion testing results indicated few chemical effects on the Teflon<sup>R</sup> visor material, with Viton<sup>R</sup>/chlorobutyl laminate moderately affected, and chlorinated polyethylene greatly affected. No chemicals permeated the FEP Visor material within three hours, but the Viton<sup>R</sup>/chlorobutyl laminate and CPE exhibited breakthrough to 15 and 30 chemicals, respectively.

Prototype suits were constructed from each of the three materials and tested for integrity, function, and fit. All suit prototypes displayed a high level of integrity in both unmanned and manned tests where suits were placed in a closed chamber and exposed to a dioctyl sebacate (DOS) serosol. Nonetheless there was some uncertainty in the efficiency of the test protocol to accurately measure suit inward leakage rates since most chemical exposures involve chemical gases and vapors as opposed to aerosols. Function testing was conducted to simulate different physical tasks representative of hazardous chemical response activities. During these tests, various physiological parameters were measured under a number of environmental conditions to determine levels of heat stress and the effectiveness of a newly designed, water-recirculating cooling system. The results of these tests indicated that the suit enabled the warer to perform most functions, however, the effectiveness of the cooling system was judged questionable even though most test subjects indicated a "feeling of improved comfort" when wearing it. Fit tests identified improvements in the suit design in terms of dimensions, seaming, and placement of components.

Following the development contract, Coast Guard Engineering engaged in preparing specifications for each of the three suit materials (Viton<sup>R</sup>/chlorobutyl laminate, butyl rubber, and chlorinated polyethylene) and the suit cooling system (described in reference 3). Despite the relative poor performance of CPE, it was retained in the Coast Guard's chemical protective suit "system" because of its resistance to inorganic acids and bases, and other chemicals with high spill frequencies. Concurrent with developing suit specifications, a new materials testing effort was launched to provide additional data on the selected materials.

#### CHAPTER 2

#### EXPANDED TESTING OF THE ORIGINAL MATERIALS

The Coast Guard R&D Center began to test the three garment and visor materials to further determine their resistance to other chemicals and mixtures under various conditions. Since the chemicals selected for testing in the development contract were only those chemicals incompatible with butyl rubber, one aim of this additional chemical testing was to determine whether Viton<sup>R</sup>/Chlorobutyl laminate and chlorinated polyethylene could provide the same protection as butyl rubber, i.e., using a two material suit system as opposed to a three material suit system. Other objectives included measuring chemical resistance against additional chemicals, and investigating the effects of temperature, chemical contact time, and mixtures.

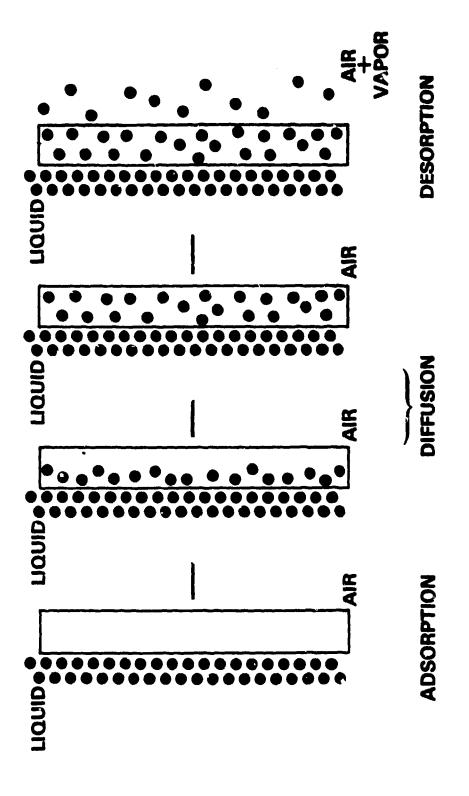
In the previous Coast Guard development contract, material chemical resistance was assessed by two different methods-degradation resistance (immersion testing) and permeation resistance. Since that contract, the American Society for Testing and Materials (ASTM) established standard methods for measuring each material-chemical interaction. ASTM defines degradation as "the deterioration in a material of one or more physical properties upon surface contact by a chemical". Degradation resistance is measured by exposing a material sample to a chemical and noting changes in its physical properties. In previous testing, the Coast Guard measured weight gain (loss) and tensile elongation as well as noting changes in physical appearance. Permeation, on the other hand, is the flow of a chemical through a material on a molecular level (Figure 1 illustrates the steps in the permeation process). Permeation resistance is similarly measured by exposing the external surface of a material sample to a chemical, but involves measuring the time for the chemical to be detected on the other side (interior) of the material. This "breakthrough" time is characteristic of the material/chemical combination. Of the two methods, the Coast Guard decided to exclusively measure permeation resistance for determining material-chemical compatibility. Permeation testing is the preferred technique for cvaluating protective clothing materials since permeation can occur without visible evidence of degradation. A number of such cases were reported in the previous testing.

#### Test Plan

A comprehensive test plan was developed to systematically evaluate material/chemical compatability and the conditions affecting perseation. Designing the test plan involved selection of priority chemicals, materials to be tested, testing methods, and ranges of each parameter<sup>4</sup>.

Chemical Selection. The list of 1100+ CHRIS chemicals was reviewed using criteria based on encapsulation requirements, toxicity, and spill frequency (history). Encapsulation requirements were taken from an earlier survey of CHRIS chemicals conducted for the Coast Guard by MSA Research Corporation<sup>2</sup>. Chemical toxicity was judged on the basis of carcinogenicity, skin absorption hazards, and various toxicity hazard ratings (such as those by the National Fire Protection Association), and divided into three groups (high, moderate,

# MATERIAL-CHEMICAL PERMEATION



Pigure 1

and low). Priority chemicals are those with both a spill history and a need for encapsulating protection, and of alther high or moderate toxicity. Also included in the priority list are all chemicals of high toxicity whether or not these chemical need encapsulation or have a spill history. This oversil priority list includes 116 chemicals which are listed in Table 1. The specific selection criteria are documented in the Coast Guard Report, "Selection of Priority Chemicals for Permation Testing and Hazardous Chemical Spill Detection and Analysis. Appendix A shows the groupings of these chemicals by priority classes. Additionally, preliminary parameter studies employed an evolving battery of test chemicals. Table 2 lists the fifteen standard chemicals which have been adopted by the ASTM for material chemical testing. These chemicals represent a range of chemical classes and properties.

Test Materials. The Coast Guard rested the selected materials-Witcak/Chlorobutyl laminate, butyl rubber, and chlorinated polyethylene (CPE). These materials are described in Table 3. The majority of experiments in this study involved the Viton laminate and CPE since butyl rubber had boen thoroughly evaluated in the earlier investigation by MSA Corporation. ChemTech Rubber in New Haven, Connecticut, custom manufactured the Viton<sup>R</sup>/Chlorobutyl laminate using specifications developed by ILC Dover. The VitonR coating is used on the external surface whereas somewhat thicker chloroburyl is used on the inside of the suit. Chlorinated polyethylene material samples were provided by ILC Dover's CPE is a proprietary blend fabricated for both increased integrity and heat sealing characteristics. Unlike the other materials, the CPE considered by the Coast Guard has no fabric substrate and consists of two plys bonded together. The previous study demonstrated poorer chemical resistance for the supported CPE materials. Butyl rubber used in the testing conformed to MIL-C-12189 and was fabricated by Plymouth Rubber in Canton, Massachussetts.

Test Methods. ASTM Standard Method F739 or modified versions of this test method were used in all permeation testing.9 A diagram of the test cell apparatus is given in Figure 2. Typical data from a representative test are illustrated in Figure 3. Both permation breakthrough time and steady state permeation rate were generally measured, although, breakthrough time is primarily used to assess material performance. The test method does not specify the duration of the test, the collection medium, or the chemical detection method. A three hour test period was chosen for testing material/chemical permeation since three hours is considered the maximum suit life during a chemical exposure (though suits are generally worm for one hour or less). All tests were run for at least three hours with breakthrough times reported in minutes. When no chemical breakthrough was detected, tests were usually terminated at the end of three hours. A detection method and corresponding collection medium were selected for each priority chemical taking into account the analytical technique's sensistivity for detecting that chemical. Two collection media were used -- air and water. Detection methods specified include gas chromatography (with either flame ionization, electron capture, or flame photometric detectors), colorimetric techniques, ion chromatography (anion or cation columns), use of specific ion electrodes, polarography, and infrared spectroscopy. Table 1 provides the recommended detection methods/collection media for the list of priority chemicals.

Ranges of Test Parameters. The parameters contact time, chemical state,

TABLE 1
LIST OF PRIORITY LIQUID CHEMICALS

CHEMICAL	CHRIS CODE	ENCAPSULATION NEED? (a)	NO. SPILLS	HAZARD IMDEX	NFPA INDEX	RECOMMENDED
			0.1110	TUDEX	TUDEX	DETECTORS
Acetaldehyde	AAD	Yes	4	3	2	FID
Acetic Acid	AAC	Yes	13	3	2	FID
Acetic Anhydride	ACA	Yes	2	3	2	IR
Acetone	ACI	Yes	11	3	1	FID
Acetone Cyanohydrin	ACY	Yes	0	2S	4	FID
Acetonitrile	ATN	Yes	ž	3	2	FID
Acetophenone	ACP	No	ō	1	1	FID
Acetyl Chloride	ACE	Yes	ĭ	-	3	IR
Acrolien	ARL	Yes	ī	_	3	FID
Acrylic Acid	ACR.	Yes	10	3	3	FID
Acrylonitrile	ACN	Yes	12	18	4	
Adipontrile	ADN	Yes	4	4	2	FID
Allyl Alcohol	ALA	Yes	2	2S	3	FID
Allyl Chloride	ALC	Yes	Õ	23	3	FID
Aniline	ANL	Yes	2	2	3	HD, FID
Benzene	BNZ	Yes	91	1		FID
Benzyl Chloride	BCL	Yes	1	2	2	FID
Bromine	BRX	Yes	Ō	-	3	PID
n-Butyl Acetate	BCN	No	1		4	PLRG, CLMT
n-Butyl Acrylate	BTC	No	1	3 3	1	FID
n-Butylamine	BAM	Yes			2	FID
n-Butyl Alcohol	BAN	No	1	2S	2	FID
Butyraldehyde	BTR	Yes	2	<b>3</b> S	1	FID
Carbon Disulfide	CBB	Yes	2	5	2	PID
Carbon Tetrachloride	CBT	No	0	2S	2	ECD
Chlordane (25%)	CDN	No Yes	6	18	3	HD, ECD
Chlorbenzene	CRB	No	3	_	-	ECD
Chloroform	CRF	No Yes	1	3	2	HD, ECD
Chlorpicrin	CPL	Yes	3	1	2	HD, ECD
Chlorosulfonic Acid	CSA	Yes	0	_	4	HD, ECD
Creosote	CCT	Yes	1	2	3	IC(A)
m-Creso1	CRL	No	0	5	2	PID
Crotonaldehyde	CTA	Yes	33	3S	3	FID, CLMT
Cumene Hydroperoxide	CMH	Yes	0	2	3	FID
Cyclohexane	CHX	Yes	0	_	1	FID
1,2-Dibromoethane	EDB	Yes	17	3	1 3	FID
1,2-Dichloroethane	EDC	Yes	0	15	3	HD, ECD
2,2-Dichloroethyl	DEE	Yes	0 0	3	2	HD, ECD
<b>Ether</b>			U	2\$	_	HD, ECD
Dichloromethane	DCM	No	4	3	2	HD, ECD
1,2-Dichloropropane	DPP	Yes	2	3 3	2 2 2 2	FID, ECD
1,3-Dichloropropene	DPR	No	0	28	2	HD, ECD
Diethylamine	DEN	No	0	3	2	FID
Diethanolamine	DEA	No	2	3 3	_	FID
Dimethylsulfate	DSF	Yes	0	_	4	PPD
Diisopropylamine	DIA	No	Ō	25	3	FID
Dimethylformamide	DMF	No	Ö	35	i	FID

TABLE 1 (Continued)
LIST OF PRIORITY LIQUID CHEMICALS

CHEMICAL	CHRIS	ENCAPSULATION NEED? (a)	NO.	HAZARD	NFPA	RECOMMENDED
		1111111 (4)	SPILLS	INDEX	INDEX	DETECTORS
1,4-Dioxane	DOX	No	0	28	2	FID
Di-n-Propylamine	DNA	Yes	Ö	5	3	FID
Epichlorohydrin	EPC	Yes	ì	2S	3	HD, ECD
Ethion 4	<b>BTO</b>	Yes	ī	~		PPD
Ethyl Acetate	BTA	No	ī	3	1	FID
Ethyl Acrylate	EAC	Yes	11	3	2	FID
Ethyl Alcohol	EAL	No	9	3	ō	FID
Ethylamine (70%)	EAM	Yes	3	2	3	FID
Ethyl Benzene	ETB	No	3	3	2	FID
Ethylene Cyanohydrin	ETC	Yeε	ĭ	5	2	FID
Ethylenedlamine	RDA	No	5	3	3	HD, ECD
Ethylene Glycol	EGL	No	23	3	1	FID
Ethyl Ether	EET	No	1	3	2	FID
Formaldehyde (37%)	FMS	Yes	17	1	2	CLT
Furfural	FFA	No ·	1	3	2	FID
Gasoline	GAT	No	ō	3	1	FID
Glutaraldehyde(sol'n)		Yes	Ŏ	2	-	FID
Hexane	НХА	No	4	3	1	FID
Hydrazine	HDZ	Yes	Ŏ	-	3	
Hydrofluoric Acid	HFA	Yes	6	3	4	PLRG, CLMT IC(A), CLMT
Hydrogen Peroxide (30%)	HPO	Yes	2	-	2	CLMT
Isopropyl Alcohol	IPA	No	0	3	1	FID
Isopropylamine	IPP	Yes	Ŏ	2	3	FID
Malathion (50%)	MLT	Yes	2	_	_	FPD
Methyl Acrylate	MAM	Yes	ī	3	2	FID
Methyl Alcohol	MAL	No	11	3	1	FID
Methyl Ethyl Ketone	MEK	No	6	3	ī	FID
Methyl Isobutyl	MIK	Yes	5	3	2	FID
Ketone			•	•	-	LID
Methyl Methacrylate	MMM	No	3	3	2	FID
Methyl Parathion	MPT	Yes	1	<u>-</u>	4	FPD
Motor Fuel Additives	MFA	Yes	ō	_	_	ECD
(Lead Alkyls)			•			
Naled	NLD	Yes	1	_	_	ECD
Mapthalene	MLT	No	10	3	2	FID
Nitric Acid	NAC	Yes	8	2	3	IC(A), CLMT
Nitrobenzene	NTB	Yes	ī	2S	3	ECD CIMI
2-Nitropropane	NPP	Yes	Ō	1	1	FID ,FPD
01eum	OLM	Yes	Ŏ	3	3	
Parathion	PTO	Yes	ĭ	_	4	IC(A), CLMT FPD
Petroleum Ether	NSS	No	Ō	3	2	FID
Phenol	PHN	No	26	2S	3	
Phosphoric Acid	PAC	ИЭ	22	3	2	FID, CLMT IC(A), CLMT
Phosphorous	PPO	Yes	1	~	<b>.</b>	
Oxychloride			-			IC(A), CLMT

TABLE 1 (Continued)

LIST OF PRIORITY LIQUID CHEMICALS

CHEMICAL	CPRIS CODE	ENCAPSULATION NEED?	NO. SPILLS	HAZARD INDEX	nfpa index	RECOMMENDED DETECTORS
Phosphorous Trichloride	PPT	Yes	0	-	3	ECD
Polychlorinated Biphenyls	PCB	Yes	92	-	-	ECD
Proplonic Acid	PNA	No	1	3	2	FID
n-Propyl Alcohol	PAL	No	1	3	2	PID
n-Propylamine	PRA	Yes	0	4	3	FID
Propylene Oxide	POX	No	1	2	2	FID
Silicon Tetrachloride	STC	Yes	0	3 5	-	BCD
Sodium Hydrosulfide	SHR	Yes	2	5	-	IC(A/Cat), CLMT
Sodium Hydroxide	CSS	Yes	0	3	3	IC(Cat)
Styrene	STR	No	59	2	2	FID
Sulfur Monochloride	SFM	Yes	1	-	2	IC(A), CLMT
Sulfuric Acid (95%)	SFA	Yes	128	3	3	IC(A), CLMT
1,1,2,2-Tetrachloro- ethane	TEC	Yes	<b>0</b>	2	3	HD, ECD
Tetrachloroethylene	TTL	No	0	3	2	HD, ECD
Tetraethyl lead	TEL	Yes	1	_	3	ECD
Tetraethyl pyrophosphate	TEP	Yes	1	-	-	FPD
Tetrahydrofuran	THF	Yes	4	3	2	HD, ECD
Tetramethyl lead	TML	Yes	0	-	3	ECD
1,1,1-Trichloroethane	TCL	Yes	5	35	2	HD, ECD
Trichloroethylene	TCE	Yes	5	2	2	HD, ECD
Toluene	TOL	No	81	<b>3</b> S	2	FID
o-Toluidine	TLI	No	0	1	3	FID
Toluene-2,4- Disocyanate	TDI	Yes	0	2	3	FID
Turpentine	TPT	No	5	3	<b>J</b> .	FID
Vinyl Acetate	VAM	Yes	8	2	2	FID
Vinylidene Chloride	VCI	Yes	8	2	1	HD, ECD
Xylenes	XLM	No	92	3	2	FID
Xylenol	XYL	Yes	1	5	3	FID

<sup>(</sup>a) Need for encapsulating protection determined in reference (2).

<sup>(</sup>b) Number of spills reported in Coast Guard Pollution Incident Response System (1973-1983).

<sup>(</sup>c) Hazard Index is based on Chemical Toxicity Ratings reported in reference (5).

1 is most toxic (carcinogen); 6 is least toxic; S - skin absorption hazard.

<sup>(</sup>d) NFPA Health Hazard Rating (from reference 6)

# TABLE 1 (Continued)

# LIST OF PRIORITY LIQUID CHEMICALS

# (e) Explanation of Detector Crie and Collection Media

METHOD OF DETECTION	COLLECTION MEDIUM
Gas Chromatographic Techniques	
FID = Flame Ionization Detector	air
ECD = Electron Capture Detector	air
Hall = Hall Detector	air
FPD = Flame Photometric Detector	air
Colorimetric Techniques	
CLMT = Colorimetric standard method or commercial test kit based on specific chamical method	water
Ion Chromatography	
IC(A) = Anion column	water
IC(C) = Cation column	water
Other Techniques	
SI = Specific ion electrodes	water
PLRG = Polarography	water
IR = Infrared spectrographic analysis	s air

TABLE 2

# LIST OF ASTM 71001 RECOMMENDED CHEMICALS

# Chemical

Acetone
Acetonitrile
Carbon Disulfide
Dichloromethane
Diethyl Amine
Dimethylformanide
Ethyl Acetate
Hexane

Methanol Nitrobenzene Sodium Hydroxide Sulfuric Acid Tetrachloroethylene Tetrahydrofuran

Toluene

# Chemical Class

Ketone Nitrile

Sulfur Containing Compound Chlorinated Parrafin

Amine Amide Ester

Aliphatic Hydrocarbon

Alcohol

Nitrogen Containing Compound

Inorganic Base Inorganic Acid Chlorinated Olefin

Oxygen Heterocyclic Compound

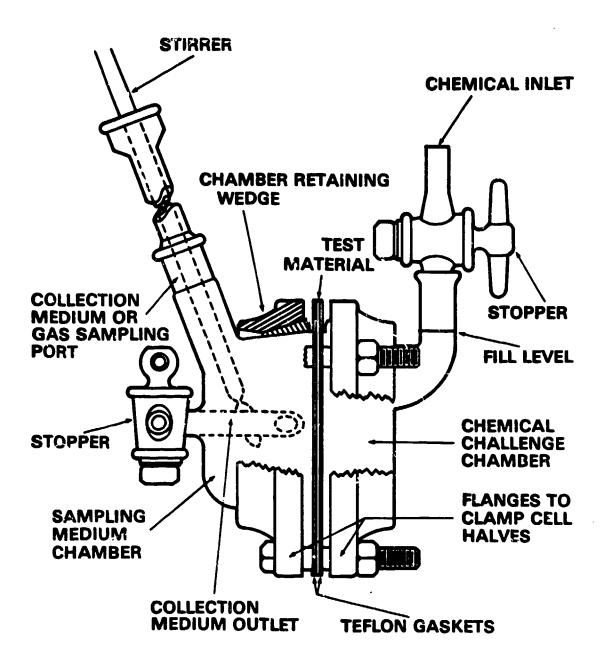
Aromatic Hydrocarbon

TABLE 3

OR GINAL SELECTED CHEMICAL PROTECTIVE SUIT MATERIALS

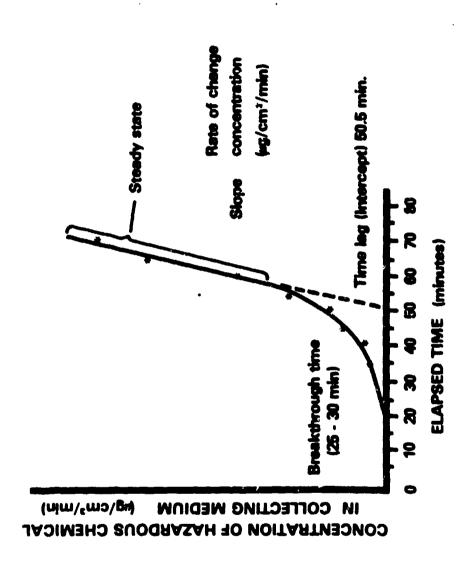
Material (Source)	Colo:	Thickness (mil)	Weight (oz/yd2)
Viton <sup>R</sup> /Chlorobutyl Laminate (ChemTech Rubber, New Haven, C	T)	13.8	14
Outer Costing: Viton <sup>R</sup> Substrate: Polyester	Orange-Red	4.7	5-6 3 5-6
Inner Coating: Chlorobutyl	Dark Grey	9.1	5-6
Butyl Rubber (Plymouth Rubber, Canton, MA)		14.0	13
Outer Coating: Butyl Substrate: Nylon Inner Coating: same as oute	Grey er coating	7.5	5–6 3
Chlorinated Polyethylene (ILC Dover, Frederica, DE)	White	27	19

No substrate, two ply, heat bonded film



# **PERMEATION TEST CELL**

Figure 2



Typical Permeation Test Output (Closed Loop System)

Figure 3

tomperature, and chemicals in Mintures were investigated in preliminary studies to observe general trends for salected saterial/chemical combinations. Procedures in ASTN F793 divolve constant contact with the material sample for the duration of experiment. However, this type of material/chemical contact is not always representative of typical field exposures. The Coset Guard RMI Center modified the standard mathod to allow the three hour periods. Chemical contact was designed to simulate the own of the three hour periods. Chemical contact was designed to simulate the own effect of a 'splash', i.e., the somentary contact of a liquid chamical with the material. Three different interatitant contact periods were chosen: one splesh every fifteen minutes (12 splashes per three hour period), one splash every hif hour (6 splashes during the test period), and one splash at the beginning of the three hour test period. Extra period, one splash every hif hour (6 splashes during the test period), and one splash at the beginning of the three hour test period. Liquids and gasse were the only chamical states invastigated. The current ASTN Standard Mathod does not lend itself for persention testing of solid chraicals. Persention testing of solid chraicals. Persention testing of solid chraicals. Persention testing of each call. The range of temperature considered in studying its affect was 0 to 50 degrees Celsius, representing the temperatures that may be encountered in the field. Only simple binary sixtures were considered in this part of the study. Permeation breathrough was measured for each component of the mixture.

General Permeation Testing

Table 4 lists the breathrough times for some priority chemicals and those in the recommended ASTN lists. All these tests were conducted under ambient conditions of temperature with constant material/chemical broat through both the Viton-Chilorobutyl lists. All those tests were conducted under ambient conditions of temperature with constant section of the conduction of the period of th

TABLE 4

PERMEATION BREAKTHROUGH TIMES OF COAST GUARD CANDIDATE SUIT MATERIALS FOR SELECTED CHEMICALS

# Breakthrough times (minutes)a

Chemical	Viton/CBb	Butyl Rubberb	CPE <sup>D</sup>	
Acetaldehyde	30-40		10-30	
Acetic Acid	No BIC	No BT	No BT	
Acetone	52-77	No BT	20-25	
Acetonitrile	90-105	No BT	80-85	
Benzene			71-75	
Carbon Tetrachloride	-		No BT	
Chloroform	No BT	11-15	30-35	
Cyclohexane	-		No BT	
Dichloromethene	25-36	0-1	15-25	
Dimethyl Sulfoxide	No BT		No BT	
Ethyl Acetate	20-40		58-70	
Bthyl Acrylate	14-32	34-45	65-70	
Freon TF (113)	No BT	35-40	No BT	
Hexane	No BT	13-16	No BT	
Lindane in Chloroform	No BT	0-10		
Lindane in Xylenes	No BT	80-90		
Methanol	No BT	No BT	No BT	
Methyl Ethyl Ketone	25-40	E.48=	28-35	
Styrene	No BT	0-1	50-70	
Tetrahydrofuran	9-11	7-14	27-39	
Toluene	No BT	0-6	69-75	

<sup>(</sup>a) Breakthrough times measured using ASTM F739-81 Standard Method with a Gas Chromatograph/Flame Ionization Detector (approximate sensitivity - 1 ppb).

(b) The materials tested were as follows:

2. Butyl rubber - nylon butyl cloth as per Military Specification Mil-C-12189 (13 mil thickness)

3. CPE - Chlorinated Polyethylene, 30 mil thickness, unsupported

(c) "No BT" denotes no breakthrough within three hour period.

Viton/CB - Viton/chlorobutyl laminate; 5 oz/yd<sup>2</sup> viton (outer or exposed surface), polyester, and 5 oz/yd<sup>2</sup> chlorobutyl rubber (inner surface); 14 mil total thickness.

PERMEATION BREAKTHROUGH TIMES OF SEVERAL MATERIAL/CHEMICAL COMBINATIONS FOR VARYING EXPOSURE CONDITIONS

# Breakthrough Time (mins.)

Mccerial/Chemical	Liquid	Liquid Splash(a)			Vapor	
Combination	•	12X	6X	1.7	25°C	0°C
Viton <sup>2</sup> /Culorobutyl N	aminate:			······································		
Acetone	<b>43-58</b>	43-58	73-78	94-100	63-74	3 hrs.
Dich.loromethane	25 <b>-3</b> 6	30-35	30-35	30-35	35-55	3 hrs.
Methyl Ethyl Ketone	25-40	35-40	35-40	50-55	80-85	3 hrs.
Tetrahydrofuran	9-11	11-17	11-17	11-17	35-45	3 hrs.
Chlorinated Polylethy	71ene:					
Acetone	32-35	50-53	68-72	75-85	130-140	3 hrs.
Chloroform	30-37	46-50	81-86	120-125	132-138	(P)
Dichloromethane	15-24	20-26	25-30	26-32	32-40	3 hrs.
Methyl Ethyl Ketone	28-35	40-45	45-50	46-49	141-148	3 hra.
Tetrahydrofuran	27-39	39-45	51-58	62-72	105-111	3 hrs.

<sup>(</sup>a) Liquid splash testing: 12X - one splash every 15 minutes; 5X - one splash every 30 minutes; 1X - one splash at beginning of test.

<sup>(</sup>b) Test not performed.

breakthrough time with varying contact (excluding vapor data). Figure 4 illustrates both phenomena graphically: the two cases on the left hand side of Figure 4 show increasing breakthrough times with decreasing contact while the right hand side gives two examples of nearly constant breakthrough time with changing chemical contact. It is interesting to note, that in some of the 12X and 6X splash testing, permeation breakthrough occurs before a majority of the individual splashes. For example, tetrahydrofuran breaks through Viton<sup>R</sup>/chlorobutyl laminate after the second splash in the 12X test and after the first splash in the 6X test.

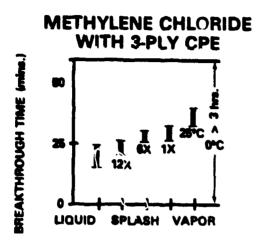
The expected behavior for reducing chemical contact with the material, is an increase in the permeation breakthrough time. If changing liquid contact has little effect on the breakthrough time, then the permeation of the material must be due to the initial 'wetting' of the material. It follows that this initial splash provides extended contact of the chemical with the material. It is therefore reasonable to postulate that the ability of the chemical to 'wet' the material is a factor in this phenomenon. An investigation of this factor is needed to establish if this behavior is predictable on the basis of chemical properties with respect to a particular material. Liquid versus vapor permeation generally followed the expected results for all material/chemical combinations tested.

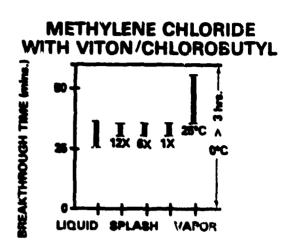
# Temperature Effect Experiments

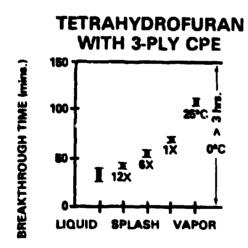
The ASTM Standard Method F739 states that permeation tests should be run at temperatures 21 ± 5°C. Early in the work of this materials testing program, differences in permeation testing were being observed for tests run of different days. An examination of the ambient conditions for those days, showed small differences in temperature which affected permeation measurements (see Table 6). Table 7 shows results for measuring the effect of the temperature on the breakthrough time for two chemicals (dichloromethane and methyl ethyl ketone) against Viton<sup>R</sup>/chlorobutyl laminate. These breakthrough times were measured using a thermostated permeation test cell. As expected, permeation breakthrough time increases with decreasing temperature because molecular energy also decreases. The same trend is evident for vapors as well. Significant differences in breakthrough times are noted between the saturated vapors at 25°C and 0°C as reported in Table 5. No breakthrough occurred within three hours for any material/chemical combination tested at 0°C.

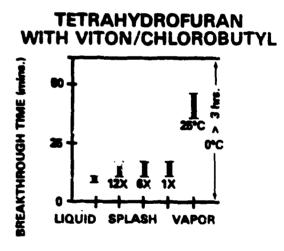
# Mixture Experiments

The permeation behavior of three simple mixtures against VITONR/
Chlorobutyl laminate was investigated. These included dichloromethane/hexane,
dichloromethane/toluene, and acetone/hexane. Table 8 shows the results for
both dichloromethane mixtures. In both cases, the second solvent (hexane or
toluene) does not break through the laminate as a pure chemical whereas
dichloromethane has a breakthrough time of 25 to 36 minutes. However, for a
50/50 (by volume) mixture of either dichloromethane and hexane or
dichloromethane and toluene, both mixture components permeated the material
samples. The breakthrough times were monitored by gas chromatography,
therefore it was possible to distinguish individual breakthrough times for









Graphical Representation of Permeation Breakthrough Times Under Varying Exposure Conditions

Figure 4

TABLE 6
THE EFFECT OF AMBIENT TEMPERATURE ON PERMEATION BREAKTHROUGH TIME

Test Material	Temp (°C)	Acetone BT <sub>a</sub> (min)
Viton <sup>R</sup> /Chlorobutyl	20	95-98
Laminate	26.5	43-53
28 mil Chlorinated	22	32-35
Polyethylene	24.5	27-31

<sup>(</sup>a) BT - Breakthrough Time

TABLE 7

THERMOSTATED TEMPERATURE EFFECT ON DICHLOROMETHANE AND METHYL ETHYL KETONE PERMEATION BREAKTHROUGH TIMES FOR VITON/CHLOROBUTYL LAMINATE

Temperature (°C)	Breakthrough Dichloromethane	Times (min)a Methyl Ethyl Ketone
5	8-10	180-199
15	6-8	80-85
25	4-4.5	35~45
35	3.5-4	20~25
45		14-20

<sup>(</sup>a) Breakthrough times measured using ASTM F739-85; Dichloromethane breakthrough measured with GC with ECD; MEK measured by GC with FID.

PERMEATION BREAKTHROUGH TIMES FOR TWO BINARY MIXTURES
AGAINST VITON/CHLOROBUTYL LAMINATE

Percentage CH <sub>2</sub> Cl <sub>2</sub>	No. Runs	Breakthou CH <sub>2</sub> Cl <sub>2</sub>	gh Time (min) Hexane
In Hexane:			
100	1	25-36	-
50	2	\$2-47	57-62
0 (100% Hexane)	4		no BT
In Toluene:			Toluene
100	1	25-36	
50	1	45-55	58-66
0 (100% Toluene)	ī	Charles and	no BT

each component. Again, for both mixtures, dichloromethane broke through first at a time somewhat longer than its normal breakthrough time for the laminate, with the second solvent permeating about 10 minutes later than the dichloromethane. It is suspected that the dichloromethane which readily permeates the Viton<sup>R</sup>/Chlorobutyl laminate, carries the second solvent through. This is a similar conclusion reached in previous investigations by Forsberg and Faniadis<sup>11</sup> and Mickelson, Roder, Berardenelli, and Cottingham<sup>12</sup>. The longer breakthrough time for the dichloromethane can be rationalized on the basis of dilution within the mixture.

The third mixture demonstrated rather unusual behavior. Table 9 shows breakthrough times for a number of different mixtures of acetone and hexane. Acetone has a normal breakthrough time of 53 to 61 minutes whereas hexane does not permeate the laminate within three hours. Yet any combination of hexane and acetone results in a significantly shorter breakthrough time. In fact, breakthrough time occurs within ten minutes of initial mixture contact with the laminate in many cases. Furthermore, both acetone and hexane break through the laminate simultaneously as detected by gas chromatography. Most of these experiments were repeated several times to verify this behavior. This synergistic effect of the two chemicals cannot be explained in terms of the individual effects on the material by the two chemicals. In an attempt to rationalize this behavior, it was postulated that acetone permeated the VitonR layer carrying with it the hexane. Then the hexane permeated through the chlorobutyl rubber layer, taking the acetone with it to be detected at the same time. This theory is consistent with the known chemical resistance of both laminate coatings discussed earlier in the paper. However, sophisticated experiments are needed in order to verify this explanation of the permeation behavior.

# Intermanufacturer Material Variability

Included in Table 10 are material compatability recommendations for Viton<sup>R</sup>/chlorobutyl laminate and chlorinated polyethylene that appear in the "Guidelines for the Selection of Chemical Protective Clothing" 13. These recommendations are based on degradation and permeation data from vendors or laboratory test facilities; a material is recommended against a particular chemical if it shows no permeation or degradation within one hour. In comparing the recommendations against the data in Table 5, some cases exist where a material is recommended when the measured breakthrough time is less than one hour (Viton<sup>R</sup>/Chlorobutyl - carbon disulfide, dichloromethane; Chlorinated polyethylene - acetaldehyde, acetone). While there are some discrepancies, it is important to realize that material permeation resistance differs between formulations of the same generic material. Previous studies showed significant differences in breakthrough times to the same chemicals of different neoprene and nitrile rubber formulations 14,15.

Of concern to the Coast Guard was its ability to specify materials with the same chemical resistance as measured on test samples. To make this determination, additional Viton<sup>R</sup>/Chlorobutyl laminate samples were fabricated by a different manufacturer (Fairprene) having nearly the same specifications as the original laminate. The only difference was the pigmentation of both coatings and the substrate (cotton polyester or nylon). Permeation testing was conducted with the various laminates for a number of

TABLE 9

PERMEATION BREAKTHROUGH TIMES FOR ACETONE/HEXANE MIXTURES
AGAINST VITON/CHLOROBUTYL LAMINATE

Percentage Acetone	No. Runs	Breakthrough <sup>a</sup> Time (min)
100	7	53-61
95	1	0-5
86	1	6-11
50	5	2-6
35	2	0-6
15	1	6-11
5	1	0-5
1	1	0-5
0 (100% Hexane)	4	nc BT (3 hrs.)

<sup>(</sup>a) Breakthrough times reported for both acetone and hexane

TABLE 10

COMPARISON OF PERMEATION TEST DATA
AGAINST MATERIAL SELECTION RECOMMENDATIONS

	VitonR/Chlorobutyl	Laminate	Chlorinated Polyethylene	
Chemical	Breakthrough Time (min.)	GSCPC Recomm. a	Breakthrough Time (min.)	GSCPC Recomm.a
Acetaldehyde	30-40	n	10-30	R
Acetic Acid	No BT(b)	R.	No BT	
Acetone	52-77	N	20-25	<u>r</u> X
Acetonitrile	90-105	N	<b>808</b> 5	
Carbon Disulfide	11-15	$\frac{\mathbf{R}}{\mathbf{R}}$	8-10	N
Chloroform	No BT		30-35	N
Dichloromethane	25-36	R H	15-25	N
Diethyl Amine	<b>27-3</b> 0	Ħ		X
Diethyl Ether	1-10	N		R
Dimethyl Formamide	No BT	N		X
Dimethyl Sulfoxide	No BT	X	No BT	X
Ethyl Acetate	20-40	N	<b>58-</b> 70	N
Ethyl Acrylate	14-32	N	65-70	N
Hexane	No BT	R	No BT	R
Methanol	No BT	R	No BT	R
Methyl Ethyl Keton	e 25~40	N	28-35	N
Nitrobenzene	<b>170-18</b> 0	R	62	R
Sodium Hydroxide	No BT	R	No BT	R
Styrene	No BT	N	60-70	N
Sulfuric Acid	No BT	R	No BT	R
Tetrahydrofuran	911	N	27-39	N
Toluene	No BT	R	69-75	N

<sup>(</sup>a) Material/chemical compatability recommendation from "Guidelines for the Selection of Chemical Protective Clothing (Schwope, Costas, Jackson, and Weitzman, 1985), pp. 37-71. Ratings are generalized as follows:

R - recommended

N - not recommended

X - no data for recommendation

<sup>(</sup>b) "No BT" denotes no detection of breakthrough within three hour period.

<sup>\*\*\*</sup>NOTE: These reported breakthrough times are for illustrative purposes only and should not be used for selecting protective clothing in hazardous chemical response.

chemicals. Table 11 reports the breakthrough times for the different Viton<sup>R</sup>/Chlorobutyl laminates. Most results are similar, but large differences were noted for acetone, acetonitrile, carbon disulfide, and dichloromethane among the tested laminates. Even when the specifications are exactly the same (laminates B and C), significant differences still observed. However, the most evident finding from this testing is the extent of material degradation visually observed on the exposed material samples of the newly prepared Viton<sup>R</sup>/chlorobutyl laminates. The Viton<sup>R</sup> layer of these material samples buckled, wrinkled, or softened with delamination of the overall material. None of these changes were seen during the testing of the original material. Table 12 summarizes the these visual observations.

An investigation of this phenomena revealed that several different types of Viton<sup>R</sup> are used in coating fabrics, and that each of these may be cured a number of ways using various additives. For example, Laminate A employed Viton<sup>R</sup> B while the Fairprene laminates were coated with Viton<sup>R</sup> A. Viton<sup>R</sup> A is a copolymer of vinylidene fluoride and hexafluoropropylene, whereas Viton<sup>R</sup> B is a terpolymer also involving tetrafluoroethylene. Each type of Viton can be cured a number of different methods with various acid acceptor systems, fillers, and processing aids. Each of these additives can affect the chemical resistance of the finished product. 16

# Summary of Findings

The Coast Guard R&D Center's research found a number of material failures which caused concern for using these materials, even though, the three materials collectively represented the most effective combination to provide broad chemical resistance. Although some findings merely reiterated or reinforced previous observations, taken collectively these findings provided important considerations for evaluating the viability of the three suit system and the formulation of specific suit material-chemical recommendations. In the past, such recommendations have been made on the basis of material performance based on permeation or degradation resistance testing within a specified time period. While this practice may result in a recommendation that has a large 'safety factor', the limited results of this study show that certain effects should also be considered. Among these are:

- 1. The chemical resistance of a material should be directly assessed. A material's chemical resistance cannot be assumed on the results of 'similar' (generic) materials. This implies that the material specifications cannot guarantee a material with a specific chemical resitance as other similar materials.
- Liquid chemical permeation may or may not be affected by contact time (length of exposure). An indication should be provided for determining which material/chemical combinations are affected by contact time and those that are not. In general, one cannot assume that chemical splashes present a lesser hazard than continuous contact with a chemical over the duration of exposure. Therefore, the criterion of no breakthrough for one hour seems reasonable given the the large safety factor.

TABLE 11 PERMEATION I LEARTHROUGH TIMES FOR FOUR VITON/CHLOROBUYTL LAMINATES

Chemical	A	<u> </u>	<u>c</u>	<u>D</u>
Acetic Acid	No BT		No BT	-
Acetone	43-53	176-186 (3)	75-121 (4)	40-45
Acetonitrile	90-105	No BT (2)		No BT (2)
Carbon Disulfide	11-15*		118-125 (2)*	
Dichloromethane	25-36 (3)	17-29 (3)	15-23 (5)	27-30 (2)
Dimethylformamide	No BT		No BT (2)	
Ethyl Acetate	20-40		19-27 (4)	-
Hexane	No BT		No BT	
Methanol	No BT		No BT	
Nitrobenzene	170-180*		No BT (2)	
Tetrahydrofuran	4-11 (2)	15-27 (4)	11-27	9-14 (2)
Toluene	No BT		178-330 (3)	• ,•
Diethyl Ether	1-10		13 (2)	

<sup>\*</sup> Gas Chromatography with ECD

MATERIAL A - ILC Dover, Viton B on Polyester (orginal material)

MATERIAL B - Fairprene, Viton A on Polyester (first sample received)
MATERIAL C - Fairprene, Viton A on Polyester (first sample received)
MATERIAL D - Fairprene, Viton A on Nylon

<sup>(#) =</sup> Number of Test Replicates

# TABLE 12

# QUALITATIVE EFFECTS OF EXPOSURE FOR VITON/CHLOROBUTYL LANINATES TO SOLVENTS

Observations made during standard permeation tests of Fairprene\* laminates with either cotton/polyester or nylon sCrim.

SOLVENT	COTTON/POLYESTER	MYLON
Acetic Acid	Liquid penetrated Viton layer -trapped at CB interface	
Acetone	Viton softened, buckled and bubbled. Thinned.	Some Viton flecks broken away
Acetonitrile	Viton material buckled, bubbled, softened and thinned	
Dichloromethane	No change to Viton; CB layer softened and became sticky	No change
Dimethylformamide	Viton layer buckled, bubbled and delaminated from CB layer	
2-Ethoxyenthanol	Liquid penetrated Viton and was trapped between layers	
Ethyl Acetate	Liquid penetrated Viton and was trapped between layers	
Hexane	No change	
Tetrahydrofuran	Viton badly wrinkled, CB sticky and soft	Viton flecks broken away
Toltone	Some buckiling of Viton - minimal	

TE: None of these changes were observed with the ILC Dover V1 ~/Chlorobutyl samples.

- 3. Increasing temperature decreases (shortens) breakthrough time for both liquids and vapors. Some chemicals which do not break through at ambient temperatures, may permeate suit mat rials at elevated temperatures. Conversely, in cold environments, permeation is less likely.
- 4. Mixture behavior cannot always be prediced on the basis of addividual mixture component chemicals. Moreover, mixture permeation can result in drawing other chemicals through materials that normally don't permeate those materials. It may be possible that synergistic mixture permeation may be the result of complex material laminates.

Since these findings are primarily based on the preliminary experiments for two materials, it is impossible to generalize the results to different material-chemical combinations. Nevertheless, they raised serious concerns for using the three material system. As a result, the Coast Guard decided to reexamine alternative materials before it decided to begin construction of the suits based on the two or three recommended materials.

#### CHAPTER 3

#### INVESTIGATION OF ALTERNATIVE MATERIALS

In 1984, the Coast Guard initiated a review of protective clothing materials to determine if new materials with greater chemical resistance could be identified. Ideally, the Coast Guard was seeking a single material which would provide at least the same chemical protection as the combination of Viton<sup>R</sup>/chlorobutyl laminate, butyl rubber, and chlorinated polyethylene. A single material offers the advantages of reducing production costs, and suit selection problems for mixtures and unknown chemicals. Moreover, increased barrier properties can result in a material where most contamination takes place on the surface making the garment easier to decontaminate and possibly reuse (Garment reuse, however, is predicated on effective field methods to measure levels of suit contamination before and after decontamination).

The Coast Guard solicited information from material suppliers to evaluate alternative materials. Evaluation criteria for comparing alternative materials 17 were divided into three areas:

- (1) Chemical resistance,
- (2) Physical properties, and
- (3) Fabrication feasibility.

Chemical resistance performance was evaluated using the ASTM standard method for measuring permeation resistance (F739) against a representative battery of test chemicals given in Table 2. A three hour period was specified to assess the compatability of test chemicals. Permeation breakthrough times were used to judge material performance. Physical property behavior was screened based on test methods and minimum performance levels established by Coast Guard Engineering (Table 13). The performance levels were derived from physical property testing on existing chemical protective clothing materials which had demonstrated adequate material integrity and durability in actual field usage. Lastly, the material supplier had to demonstrate their ability to fabricate strong, liquid-proof seams with the garment, visor, and closure tape materials. Testing in this area included measuring seam penetration resistance (ASTM F903-8518) for selected chemicals (water, Methyl Ethyl Ketone, Hydrochloric Acid, Toluene, and Hexane) and seam tensile strength.

The Coast Guard evaluated each of the submitted material data packages using the above criteria. Due to proprietary nature of the proposals, only the selected material is described in this report. Chemical Fabrics Corporation introduced three different Challenge<sup>TM</sup> materials. Each of these materials were proprietary, aramid-reinforced fluoroelastoplastic composites (more commonly known as Teflon<sup>R</sup> laminated Nomex<sup>R</sup>). All three materials had the same type of Teflon<sup>R</sup> coating but involved a different Nomex<sup>R</sup> fabric substrate. Challenge<sup>TM</sup> LU has a non-woven subtrate, whereas both Challenge<sup>TM</sup> EW and XHS employed woven substrates of different weights (4.5 and 6.0 ounces/yard<sup>2</sup>, respectively). The principal performance differences were found in the physical properties of these materials; only Challenge<sup>TM</sup> EW and XHS met the Coast Guard requirements for material tensile, tearing, and bursting strengths (Table 14). Challenge<sup>TM</sup> EW was selected over

#### TABLE 13

# U. S. COAST GUARD SPECIFICATIONS FOR ALTERNATIVE PROTECTIVE CLOTHING MATERIALS

- A. Chemical Resistance: Measure and report permeation breakthrough time of the material using ASTM F739-85, "Standard Test Method for Resistance of Protective Clothing Materials to Permeation by Liquids and Gases" for the ASTM F1001-86 Chemicals listed in Table 2; Continue each test for three hours or until steady-state permeation is achieved.
- B. Physical Properties: The material shall meet the following physical property requirements:

Property	Test Method	CG Requirement(type)
Weight (oz/yd <sup>2</sup> )	ASTM D751-79	25 (max)
Thickness (mil)	ASTM D751-79	20 (max)
Tensile Strength (1bs/in.)	ASTM D751-79	80 Warp (min) 80 Fill (min)
Tear Strength (lbs)	ASTM D751-79	9 Warp (min) 10 Fill (min)
Busting Strength (psi)	ASTM D751-79	200 (min)
Abrasion Strength	FRD STD 191A-5302	No loose fibers
Low Temp. Bending at -20°F	ASTM D2136-66	Pass
Flammibility	ASTM D568-68	Self-extinguishing

C. Fabrication Potential: Demonstrate ability to fabricate seams of garment material to garment material, garment to visor (5-10 mil Teflon<sup>R</sup> FEP), garment to closure tape (neoprene). Measure garment material seam strength using ASTM D751-79, "Standard Test Methods for Rubber Coated Fabrics" (CG Requirement-50lbs.) and seam integrity using ASTM F903-85, "Standard Test Method for Resistance of Protective Clothing Materials to Penetration of Liquids (CG Requirement - Pass & 2 psi for water, hexane, toluene, methyl ethyl hetone, and hydrochloric acid)

TABLE 14

PHYSICAL PROPERTY CHARACTERIZATION OF CHAILENGETH MATERIALS

PROPERTY	TEST METHOD	CHALLENGE LU	CHALLENGE EN	CHALLENGE XHS	REQUIREMENT
Weight (oz/yd)	ASTM D751-79	10.2	11.1	16.9	25 (max.)
Thickness (mil)	ASTM D751-79	15.2	14.1	18.4	20 (max.)
Tensile Strength (1bs./in.)	ASTM D751-79	46.0 (W) 29.8 (F)	113.7 (W) 95.8 (P)	218.5 (W) 184.5 (P)	80 (V) 80 (F)
Tear Strength (1b.)	ASTH D751-79	12.4 (W) 6.4 (F)	21.0 (W) 19.6 (F)	18.0 (W) 17.3 (P)	9 (W) 10 (F)
Bursting Strength (psi)	ASTH D751-79	172.5	273.0	443.3	200
Abrasion Resistance	FED. STD. 191A-5302	No loose fibers	No loose fibers	No loose fibers	No loose fibers
Low Temperature Bend (-25°F)	ASTH D2136-66	Pass	Pass	Pass	Pass
Planmability	ASTM D568-68	Non-Burning	Non-Burning	Hon-Burning	
Relative Cost Index		1.0	2.5	6.0	1

Challenge TM XHS since its unit material cost was lower by a factor of 2 and still met Coast Guard physical property requirements. Challenge TM LU and EW eventually became known as Challenge TM 5000 and 5100, respectively.

Challenge<sup>TM</sup> 5100 exhibits a high level of chemical resistance and possessed equal or better physical properties relative to the Coast Guard's originally selected materials. Tables 15 and 16 show a comparison of this material's physical properties and permeation results with prior selected materials. Seam performance data provided by Chemical Fabrics Corporation showed garment material seams to have a tensile breaking strength of 95.5 lbs. (using ASTM D751-79) and as passing the ASTM Penetration Test. On the basis of this data, the Coast Guard elected to forego production of suits based on Viton<sup>R</sup>/chlorobutyl laminate, butyl rubber, and chlorinated polyethylene, and instead redirected its suit development effort for fabricating suits using the new Challenge<sup>TM</sup> 5100 material.

The Coast Guard also adopted a Teflon<sup>R</sup> FEP visor which facilitated suit fabrication while eliminating lamination difficulties inherent to the FEP/Surlyn composite. Additionally, different Teflon<sup>R</sup> glove material were chosen and evaluated for use in the Coast Guard Chemical Response Suit. The Coast Guard opted for Teflon components in the suit design where possible to provide a suit with improved uniformity in chemical resistance throughout the garment. The only two major non-Teflon components are the suit closure (a neoprene-brass pressure sealing sipper) and exhaust valves (nylon and silicone rubber).

PHYSICAL PROPERTY REQUIREMENTS AND DATA FOR CAMDIDATE CARMENT MATERIALS

			Materials	tales.		
Property (Units)	Test Method	Coast Guard Requirement	Chlorinated Polyethylene	Buty1 Rubber	Vitoul/ Chlorobutyl	Challenge Di 5100
Weight (oz/yd <sup>2</sup> )	ASTH D751	25 (mex.)	19.3	13.6	15.3	11.4
Thickness (mil)	ASTH D751	20 (mex.)	20	14.2	19.0	18.1
Tensile Strength (1b/in) w - warp; f - fill	770. STU. 191A, 5102	80 w (min.) 80 f (min.)	87 (w) 99 (£)	135 (4) 86 (5)	254 (#) 254 (F)	114 (v) % (r)
Tear Strength (16/1n)	720. STD. 1914,5134	9 w (min.) 10 w (min.)	13 (w) 17 (f)	9.5 (w) 15.5 (f)	9.7 (w) 11.0 (f)	9.6 (q) 10.0 (f)
Hydrostatic Resistance (Fe1)	770. S70. 1914,5512	200 (mim.)	200	325	383	315
Abrasion (gas lost) H-18 Wheel, 600 cycles	77.0. 570. 191A, 5306	0.30 (mex.)	.39	16,	(4)	.05
Stiffmess - Warp (cm)	720. STD. 191A, 5200	5.0 (mer.)	No data	No dats	No data	4.5
Flammability Ignition Time (sec.) Burn Time (sec.) Burn Distance (cm.)	ASTH 19568°C	9 800 e	2.4 87 6.7	0.8 22 8.0	0.8 47 7.5	Dees not ignite n/s n/a
Low Temperature Bending Homent (H-m)	720. <b>570.</b> 191A, 5202	0.025 (max.) @ 0.037 007 (60° def.)	0.037	0.00	No data	0.019

All materials have fabric supporte; data for first three materials from ref. (3).
\*\*Exposed fibers of the base material appeared after 600 cycles
\*\*CA modified form of ASTM D568 is used to measure flammability; Exposure conditions of FED 191A,
\*\*Hethod 5903 are used with measurement of ignition time, burn time, and distance burn. The Coast Geard is in the process of establishing a quantitative requirements for these parameters. The current requirement specifies that material is self-extinguishing.

TABLE 16

COMPARISON OF PERMEATION RESULTS FOR CHLORINATED POLYETHYLENE,
VITON/CHLOROBUTYL LAMINALL, AND CHALLENGE 5100

### Breakthrough Time (minutes)&

	Chlorinated Polyethylene	Viton <sup>R</sup> /Clorobutyl Laminate	Challenge <sup>TM</sup> 5100
Acetic Acid	No BTb	No BT	No BT
Acetone*	20-25	43-53	No BT
Acetonitrile*	80-85	90-105	No BT
Benzene	71-75	No BT	No BT
Carbon Disulfide*	8-10	11-15	13-23
Dichloromethane*	15-25	25-36	35-45
Diethyl Amine*		27-33	No BT
Diethyl Ether		1-10	No BT
1,2-Dichloroethane	15-25	No BT	No BT
Dimethyl Formamide*		No BT	No BT
Dimethyl Sulfoxide	No BT	No BT	No BT
Ethyl Acetate*	60-70	20-40	No BT
Ethyl Acrylate	14-32	34-45	No BT
Freon TF	No BT	No BT	No BT
Hexane*	No BT	No BT	No BT
Methanol*	No BT	No BT	No BT
Methyl Ethyl Ketone	<b>28-3</b> 5	25-40	No BT
Nitric Acid (conc.)	No BT	No BT	No BT
Nitrobenzene*	60-70	170-180	No BT
Sodium Hydroxide (50%)	No BT	No BT	No BT
Styrene	60-70	No BT	No BT
Sulfuric Acid (conc.)*	No BT	No BT	No BT
Tetrachloroethane	60-70	No BT	No BT
Tetrachloroethylene*			No BT
Tetrahydrofuran*	27-39	9-11	No BT
Trichloroethylene	10-15	25-30	108-143
Toluene*	69-75	No BT	No BT

<sup>(</sup>a) Breakthrough times determined using ASTM F739-81. Blanks indicate the absence of data; breakthrough times are presented as ranges due to the imprecision in determining actual breakthrough time; breakthrough time is heavily dependent of the analytical sensitivity of the detector used.

<sup>(</sup>b) No BT denotes no breakthrough detected for a three hour period.

\* ASTM F1001 Chemicals.

#### CHAPTER 4

#### SELECTION AND TESTING OF SUIT COMPONENTS

With the selection of Challenge<sup>TM</sup> 5100, the Coast Guard was able to achieve a "one-suit system" for encapsulating chemical response. Choosing other materials with similar chemical resistance was paramount to providing uniform chemical resistance for the entire garment. To this end, the Coast Guard adopted a Teflon<sup>R</sup> FEP visor which facilitated suit fabrication while eliminating lamination difficulties inherent to the FEP/Surlyn composite tested earlier.<sup>3</sup> Additionally, different Teflon<sup>R</sup> glove materials were chosen and evaluated for use in the Coast Guard Chemical Response Suit. Unfortunately, some critical parts of the suit were not available in Teflon<sup>R</sup> type materials. These include both the suit closure (a neoprene-brass pressure sealing zipper) and exhaust valves (nylon and silicone rubber). However, Coast Guard Engineering was able to design suit features which protect these components from chemical exposure. Suit design and overall suit testing are discussed in the Chapter 5.

#### Testing Strategy

The selection of the Challenge<sup>TM</sup> 5100 and Teflon<sup>R</sup> materials was based on limited data against a small number of representative chemicals. In order to support the development of a Challenge<sup>TM</sup> suit, and its use in the field, the Coast Guard initiated an extensive testing program that would document the performance of the overall suit, its materials and components. This testing program encompasses an examination of all primary suit materials (garment, visor, and glove), critical suit seams, and suit components (closure and exhaust valves). The final goals of this test program are:

- (1) to integrate test data for assessing overall suit performance, and
- (2) to establish suit use recommendations against priority chemicals.

Material performance was further characterized in terms of chemical resistance to a larger set of chemicals under various conditions, and in terms of additional physical property or functional testing. In general, each material and component should be tested in the same fashion and against the same chemicals. Practically, this is difficult due to the enormous size of the test matrix. Therefore, the Coast Guard adopted the philosophy of first testing the garment material against a large set of priority chemicals and then testing other primary materials and seams against a smaller subset of the priority chemicals. In this manner, material performance can be compared and judgements can be made on how to extend the testing of suit materials to more chemicals. Table 17 provides this matrix of suit materials/components, types of testing, and chemical batteries covered in this report. Eventually predictive models will be necessary to overcome large testing demands and the problems of making suit use recommendations for mixture exposure.

# TABLE 17

#### SUIT MATERIAL/COMPONENT TEST MATRIX

Material/Component	Type of Test	Test Chemical/ or Properties
Garment Material	Permeation <sup>a</sup>	115 Priority Liquids 25 Priority Gases* Variable effects on Selected Chemicals (temp., contact time, pressure, mixtures)**
	Strength Resistance Other Phys. Prop.	Tensile, Tear, Bursting Abrasion*, Cut*, Puncture* Stiffness, Flammability Low Temp. Performance
Creased Garment Mat'1	Permeation	ASTM F1001 Chemicals
Visor Material	Permeation	ASTM F1001 Chemicals plus chemicals permeating garment material
	Strength Resistance Other Phys. Prop.	Tear, Stiffness, Bursting* Abrasion/Clarity Light Transmission, Flammability* Low Temp. Performance*
Creased Visor Mat'1	Permeation	ASTM F1001 Chemicals
Inner Glove Material	Permeation Strength Resistance Other Phys. Prop.	ASTM F1001 Chemicals Tear, Bursting* Abrasion Stiffness, Flammability Low Temp. Performance
Outer Glove Material	Degradationb	ASTM F1001 Chemicals
Critical Suit Seams	Penetration <sup>C</sup> Permeation Strength	Water, MEK, HCl, Hexane, Toluene ASTM F1001 Chemicals Tensile, Dead Load
Suit Closure (Zipper)	Penetration Degradation Strength	Water, MEK, HCl, Hexane, Toluene ASTM F1001 Chemicals* Tensile, Bursting*

<sup>\*</sup> Test will performed in future study

\*\* Tests will conducted in study beginning August 1987

(a) Permeation Resistance measured using ASTM F739 over three hour period

<sup>(</sup>b) Degradation Resistance measured using draft ASTM F23.30.03 method(c) Penetration Resistance measured using ASTM F903

### Garment Material Evaluation

General Chemical Resistance Testing. The garment material comprises more than 75% of the total exposed surface area for the Coast Guard Chemical Response Suit. The Coast Guard Research and Development Center and its contractor, Texas Research Institute (Contract No. DTCG39-86-A-80331), tested the Challenge TM composite against 111 priority liquid CHRIS chemicals using ASTM F739 for measuring permeation resistance (6 priority chemicals were not tested due to their availability or destructiveness on the test apparatus; data for Methyl Isocyanete was provided by NIOSH18). The chemicals tested were the same chemicals described in Chapter 2 with their selection based on encapsulation requirement, spill frequency, and toxicity. The contractor established a unique method involving a continuous photoionization detector to measure material permeation parameters and minimum detection limits for each of the chemicals. Initially, each test against a respective chemical was run using three permeation cells operated in parallel, such that the output from each permeation cell went to the detector simultaneously. If any permeation breakthrough was detected, the tests were repeated with three individual test cells run singly. This arrangement was devised to minimize the time in conducting permeation tests with the expectation that few chemicals would permeate Challenge TM 5100. Their apparatus and methods are described in Appendix B.

In general, most tests were conducted for a minimum of three hours. However, several tests were extended beyond the three hour test period when permeation of the material was expected for a particular chemical. This testing identified ten chemicals that permeate the garment material within a three hour period; of these, three chemicals exhibit breakthrough in one hour (see Table 18). Data for all chemicals tested are listed in Table 19. This data include the breakthrough time and steady state permeation rate, if any, along with the specific minimum detection limit (MDL), detector used, and scurce of the test data. Complete test data and output is provided in Appendix C. The material is also being tested against priority chemical gases listed in Table 20, and eventually will be evaluated against the other CHRIS chemicals requiring encapsulation or having high toxicity.

Investigation of Chemical Resistance Variables. Chemical resistance testing of the garment material also involves investigation of parameters expected to affect material performance. These parameters include contact time, internal suit pressure, temperature, and chemical mixture exposure. This testing takes advantage of earlier work performed by the Coast Guard R&D Center on Viton/chlorobutyl laminate and chlorinated polyethylene reported in Chapter 2.10,20 Dichloromethane permeation of Challenge M 5100 at various temperatures is shown in Figure 5 and demonstrates the expected relationship between breakthrough time and temperature--a decrease in breakthrough time at elevated temperatures. Although a theoretical, predictive model for the permeation behavior of Challenge products has not been developed, an apparent inverse, linear relationship between temperature and log(breakthrough) for the limited data is observed. Additional permeation testing at elevated temperatures is planued, particularly for those chemicals which may permeate at high temperatures but not at room temperatures. Splash testing with dichloromethane using the same methods developed by the R&D Center yielded essentially the same breakthrough time as obtained when liquid remains in constant contact with the surface of Challenge TM 5100. This anamolous

TABLE 18

CHEMICALS WHICH PERMEATE CHALLENGE TM 51008

# A. Chemicals which permeate within one hour

Chemical Name	CHRIS Code	Breakthrough Time (min)	Permeation Rate (ug/cm <sup>2</sup> hr)
Carbon Disulfide	СВВ	· <b>18</b>	3.65
Acrolein	ARL	38	
Methyl Isocyanate		28	2.82 ND <sup>b</sup>
Acrylonitrile	ACN	45	5.12
Dichloromethane	DCM	47	1.37

# B. Chemicals which permeate between one and three hours

Vinyl Acetate	MAV	74	3.30
Allyl Chloride	ALC	102	0.67
Tetrachloroethylene	TTE	108	ND
Propylene Oxide	POX	137	1.43
Trichloroethylene	TCL	143	2.04

<sup>(</sup>a) Information summarized from Table 19

<sup>(</sup>b) Not determined

Table 19 Permeation Testing Results for Challenge 5100 (Teflon-Coated Nomex) All Tests Conducted at 23° - 25°C

Chem cal	CHRIS	j [3]	2 Perm	Det Met'd	MDL (ppm)		6
Acetaldehyde	AAD	>3		PID	ND	TR	_
Acetic Acid	AAC	4		FID	35.46		
Acetic Anhydride	ACA	>3		PID	0.57	TR	
Acetone	ACI	>3.5	hr	FID	1.16	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
Acetone Cyanohydrin	ACY	N. N.	/A	PID	2.74	TR	<b>II</b>
Acetonitrile	ATN	>4.5		FID	ND	R&C	
Acetophenone	ACP	>92	All the and the state of the st	FID	, , , , , ND ,	R&E	
Acetyl Chloride	ACE	>3.1	hr	PID	35.46	TR	1
Acrolein	ARL	38 mir	inner romanieri anni a	PID	0.06	TR	
Acrylic Acid	ACR	>3		PID	0.86	TR	
Acrylonitrile	ACN	45 ml	transport of the man is now a su-	2 PID	0.46	46	
Adiponitrile	ADN	<b>&gt;3.1</b>		PID	0.3	TR	
Allyl Alcohol	ALA	≥14	hr	PID	1,13	TR	
Aliyi Chloride	ALC ANL	102 m		PID	0.18	TF	
Aniline Benzene	BNZ	>3.3		PID	0.46	TH	
Benzyi Chloride	BCL	>3.2		PID	0.05	TH	
Bromine	BRX	>3.2		PID	0.11	TR	
n-Butyl Acetate	BCN	∴		PID	0.53	TR	
n-Butyl Acrylate	BTC	ત્ર પ્ર		PID PID	0.25 0.22	TA TA	
n-Butylamine	BAM			PID	0.32	TF	
n-Butyl Alcohol	BAN	>15.6		PID	0.32 0.32	7F	
Butyraldehyde	BTR	>7.5			0.29	TF	
Carbon Disuffide	CBB	17.7 m		PID	0.05	75	
Carbon Tetrachloride	CBT	>3.0	***************************************	PID	0.29	TF	
Chlordane (85%)	CDN	>3.4		PID	0.26	TF	
Chlorobenzene	CRB	>3		PID	0.20	TF	
Chioroform	CRF	>3.6		PID	0.19	. TF	
Chloropicrin	CPL	>3.1		PID	1.80	TF	
Chlorosulfonic Acid	CSA	>3.0		lon Ch		TF	
Creosote	CCT	>18.1		PID	0.32	TF	
m-Cresol	CRL	>4	hr	PID	0.03	TF	<b>સ</b> .
Crotonaldehyde	CTA	>3.1	hr	PID	0.62	TF	Ri
Cumene Hydroperoxide	CMH	>3.5	hr	PID	1.20	TF	રા 🦈
Cyclohexane	CHX	>3.4	hr	PID	0.25	TF	<b>}</b>
1,2-Dibromoethane	EDB	>3.4	hr	PID	0.10	TF	<b>3</b> [
1,2-Dichloroethane	EDC	>5.7	hr	PID	0.09	TF	
1,2-Dichloroethyl Ether	DEE	>3		PID	ND	TF	
Dichloromethane	DCM	46,8 m	30030 WWW.	PID	0.27	TA	
		<b>37</b> m		ECD	0.03	R&I	
1,2-Dichloropropane	DPP	>3.1		PID	0.31	TF	
1,3-Dichloropropene	DPR	>3		PID	0.17	TF	
Diethanolamine	DEA	>3		PID	ND	TF	
Diethylamine	DEN	>4.5	hr	FID	ND	R&I	DC :

#### Notes:

- 1. The CHRIS Code comes from the Coast Guard CHRIS list.
- 2. BT Breakthrough Time (>XHr = time test run; nMin = BT in min for those compounds that did break through.)
- 3. The permeation rate units are micrograms/square centimeter/hour.
- 4. DET MET'D Detector used for determination of BT.
- MDL Minimum Detection Limit of the detector.
   SRC Source of Data: TRI Texas Research Institute; R&DC Coast Guard results.

Chemical C	HRIS <sup>1</sup> ode	BT <sup>2</sup>	Perm <sup>3</sup> De Rate Met		Sou
	DSF	N/A	PI		
	AIC	>11.2 hr	PI		
	DMF	>3.2 hr	FIE		RA
	DOX	>3 hr		0.38	
	DNA EPC	>3.4 hr	PI		
' Di√ in the Special Company is the company of the State of the Company of the C	ETO	>3 hr >4.8 hr	PII PII		
	ETA	>4.3 hr	FIL		
	EAC	>17 hr	Pil		
	EAL	>3 hr	CONTRACT STORMAN AND AND AND A	2.86	
	EAM	>3 hr	PI	Activities and the second second	CONTRACTOR OF A STATE OF THE ST
	ETB	>3 hr	PI		
	EDA Fol	>3.2 hr	Pil		48. 4.000 A. C.
	EGL EET	>16.8 hr >3 hr	<b>P</b> 11 P10		
	FMS	>3 nr >3 hr	Pil		~~~ <b>†</b>
	FFA	>1 hr	PI		
Gasoline	GAT	>14.9 hr	Pil		
	GTA	N/A	PI	0.43	<b>T</b>
	HXA	>5 hr	PI		
	HDZ	NA	PII		
	IPA IPP	>3 hr >3 hr	PII PII		
	MLT	>3 nr >3.1 hr	PII PII		A 100000 CT   V   100 A 100 CT
	MAM	>3 hr	Pil		
Methyl Alcohol	MAL	>14.2 hr	Pil	2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 -	
Methyl Ethyl Ketone	MEK	>3 hr	Pil	D 0.65	T
	MIK	>3 hr	PII		
	MMM	>3.1 hr	Pil	A Company of the Comp	
	MPT	NA	PI		
	NLD MLT	>3.4 hr >13.2 hr	PII PII		
	ML I NAC	N/A		O Chr 0.20	
i i i i i i i i i i i i i i i i i i i	NTB	>3 hr	Pil	2.50%	114771
	NPP	>3 hr	Pil		
Oleum	OLM	>3.0 hr	lor	Chr 0.20	1
	PTO	>3.0 hr	PI		
Petroleum Ether		:-3.4 hr			
	PHN PAC	>3 hr	PI		
Phosphoric Acid Phosphorous Oxychloride		N/A >3 hr		n Chr	
Phosphorous Trichloride		>3 hr		1 Chr 0.50	
	PNA	>3 hr	PI		
n-Propyl Alcohol	PAL	⇒3 hr	PI	D 0.76	1
n-Propylamine	PRA	>10.2hr	PI	D 0.74	
	POX	137 min	1.43 PI		1
	STC	>3.0 hr	1.7	o Chr 0.50	
Sodium Hydrosulfide 3 Notes:	SHR	N/A	A/	0.50	

Table 19 Permention Testing Results for Challenge 5100 (continued)

Chemical	CHRIS <sup>1</sup>		Perm	Det <sup>4</sup>	MDL	Source
Sodium Hydroxide	Code CSS	>71	T Rate	Met'd SE	(ppm) ND	RADO
(50% aqueovs)						
Sodium Hydroxide	CSS	>3.0	hr	<b>lon C</b> h	r 0.50	TRI
(50% aquecus) Styrene	STA	*	hr	PID	0.05	TRI
Sulfur Monochloride	SFM	N	VA	lon Ch		TRI
Sulfuric Acid (conc.) 1,1,2,2,-Tetrachioro-	SFA TEO	>72 >15.2		Sulfate PID	ND 0.23	TRI TRI
ethane						eli i i i i i i i i i i i i i i i i i i
Tetrachloroethylene	TIE	108 m		ECD	ND	RADO
Tetrahydrofuran 1,1,1-Trichloroethane	THF	>5.5 >3		FID PID	ND 0.60	R&DC TRI
Trichloroethylene	TCL	143 /	nin 2.04	PID	0.07	TRI
Toluene	TOL	>3 >18.5	hr	PID FID	0.06 0.69	TRI TRI
o-Toluidine	· TLI	>3.3		PID (	्र ं 0.43	RADO
Toluene 2,4-	TDI	>3.3	and the second of the second o	PID	0.69	TRI
Diisocyanate  Turpentine	TPT	>3.6	he a second	PID	0.03	TRI
Vinyi Acetate	MAY	74 m		PID	0.21	TRI
Vinylidene Chloride	VCI	>3.0		PID	0.49	TRI
Xylenes Xylenol	XLM	>3 >3.3		PID PID	0.13 ND	TRI TRI
				many magnetic company The Company		
		ista tillissi t¥a •	7 - 1 daugs 80,7880	(USBCS st. )	insatenskatensk	
				e vigat Alvandari, kiril Defense milli vikilisi.		
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		• .		1, 68 c. 1, 3 d. 1		

#### Notes:

- 1. The CHRIS Code comes from the Coast Guard CHRIS list.
- 2. BT Breakthrough Time (>XHr = time test run; nMin = BT in min for those compounds that did break through.)
- 'arograms/square centimeter/hour. letermination of BT. 3. The permeation rate units
- 4. DET METO -- a stoctor incl.
- 5. MDL Markium Detection Limit of the detector.
  6. SRC Source of Data: 'TRI Texas Research Institute; R&DC Coast Guard results.

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TABLE 20 LIST OF PRIORITY GASEOUS CHERICALS

CHEMICAL NAME	CHRIS CODE	ENCAPSULATION NEED?	PIRS # SPILLS	HAZARD INDRX	NFPA INDEX	PRIORITY®
Ammonia	AMA	Yes	85	2	3	IA
Bromine Pentafluoride	BPF	Yes	0	-	4	IIA
1,3-Butadiene	BDI	No	0	1	2	IIA
Butane	BUT	No	()	3 2	1	IVC
Chlorine	CLX	Yes	35	2	3	IA
Chlorine Trifluoride	CTF	Yes	0	-		IIC
Cyanogen	CYG	Yes	0		4	IIA
Dimathylamine	DMA	No	0	2	3	IIA
Ethylene Oxide	EOX	Yes	0	1	2	IIA
Fluorine	FXX	Yes	0		4	IIA
Hydrogen Browide	HBR	Yes	0		3	IIC
Hydrogen Chloride	HDC	Yes	0	2	3	IIA
Hydrogen Sulfide	HDS	Yes	0	6	3	IIB
Methyl Amine	MTA	Yes	0		3 3	IIB
Methyl Bromide	MTB	Yes	0	<b>2</b> S	3	IIA
Methyl Chloride	MTC	No	15	2	2	IA
Nitric Oxide	NTX	Yes	0	6		IIC
Nitrosyl Chloride	NTC	Yes	0		-	IIC
Phosgene	PHG	Yes	0		4	IIA
Sulfur Dioxide	SFD	Yes	0	2	2	IIA
Trimethylamine	TMA	Yes	0	_	2	IIC
Vinyl Chloride	<b>VCM</b>	Yes	0	1	2	IIA

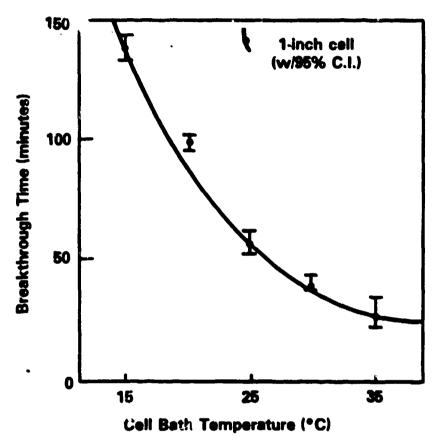
<sup>(</sup>a) Need for encapsulating protection determined in reference (2)

<sup>(</sup>b) Number of spills reported in Coast Guard Pollution Incident Response System (1973-1983).

<sup>(</sup>c) Hazard Index is based on Chemical Toxicity Ratings reported in reference (5). 1 is most toxic (carcinogen); 6 is least toxic; S - skin absorption hazard.

<sup>(</sup>d) NFPA Health Hazard Rating (from reference 6)(e) See Appendix A for chemical classification information

# Methylene Chloride Against Challenge 5100



Temperature Effect on Permeation Breakthrough Time of Challenge(TM) 5100 by Dichloromethane

Figure 5

result is not fully understood and may be a manifestation of the test procedure. Mixture testing will also be conducted to determine if synergistic permeation occurs as observed for acetone/hexane against VitonR/chlorobu:yllaminate.

Physical Property Testing. An original concern that the Teflon laminate may 'microfracture' with use 21 was investigated by a battery of physical property and chemical resistance testing. As a practice, most permeation testing is conducted with pristine material samples. Chemical Fabrics Corporation devised a standard means for creasing samples as a preconditioning technique to determine if the chemical resistance of the material changes with physical abuse (described in Appendix D). This test has been applied against the thirtoen organic chemicals in the ASTM F1001 list of standard chemicals. Results for this testing are given in Table 21 comparing both 'uncreased' and 'creased' material chemical resistance. These tests show only small changes in the permeation breakthrough times for both carbon disulfide and dichloromethane which permeate Challenge TM 5100, and no 'new' chemicals which break through the material as the result of creasing. Test data and output are included in Appendix E. Other physical property tests are being performed in separate studies to determine how well Challenge TM 5100 retains its characteristics following temperature changes and exposure to flame and abrasive surfaces.

### Visor Material Optimization and Evaluation.

Problems with the Original Teflon Laminate. Originally, the Coast Guard selected a Teflon laminate (1 mil FEP/ 20 mil Surlyn) for a visor material in its chemical protective suits. This material possessed excellent chemical resistance but was difficult to laminate and did not stay together well after use. The Coast Guard therefore decided to examine alternative visor materials and select a material without sacrificing the chemical resistance of the Teflon laminate. A requirement of using a single film (non-laminate) was tentatively set to avoid lamination problems encountered in the earlier material. Any delamination of a visor was considered unacceptable since the area between film could allow entrapment of moisture which would then cause significant loss of visor clarity through condensation and fogging.

Primary Visor Material Performance Variables. Critical performance requirements for visor materials in the Chemical Response Suit included:

- (1) high visible light transmittance and visual clarity,
- (2) chemical permeation resistance, and
- (3) physical integrity and damage tolerance.

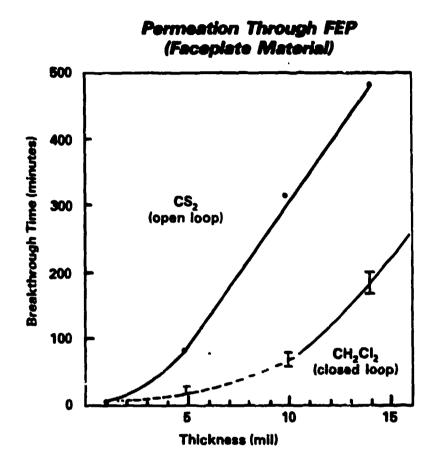
For screening purposes, light transmittance from wavelengths of 390 to 876 nm was measured with a visible light spectrophotometer using ASTM E424, "Test Methods for Solar Energy Transmittance and Reflectance of Sheet Materials." Chemical permeation resistance was performed with selected aggressive chemicals (carbon disulfide and dichloromethane) from the ASTM F1001 battery (Figure 6). Physical integrity and damage tolerance were evaluated in terms of tear strength (FED STD 191A-5136 - trapezoid method) and stiffness (ASTM D1388 - cantilever method). Stiffness was considered the more critical of the two physical properties since it is related to the ease of film creasing which

TABLE 21

POR INCREASED AND CREASED CHALLENGE 5100 SAMPLES® COMPARISON OF PERMEATION BREAKTHROUGH TIMES

	Uncreased	Uncreased Challenge 5100	<b>6</b> 1	Cressed (	Creased Challenge 5100	
Chemical	Breakthrough Time (min)	Perm. Rate (ug/cm²hr)	MDL (PPB)	Breakthrough Time (min)	Perm. Rate (ug/cm <sup>2</sup> hr)	ADI. (PPE)
Acetone	No BT6	MA	1.16	Mo NT	<b>X</b>	2
Acetonitrile	No BT	¥	09.0	16 of	<b>1</b> 2	
Carbon Disulfide	18-22	2.6-3.7	0.07	11-15	10 0-12 2	3 2
Dichloromethane	47-55	1.0-1.4	0.19	53-58	3.1-3.8	37.
Diethylamine	No BT	<b>3</b>	0.15		NA T	
Dimethylformanide	No BT	<b>1</b> 2	0.40	No BT	<b>X</b>	
Ethyl Acetate	No BT	¥	0.49	No PT	¥.	200
Hexane	No BT	KA	0.25	No BT	¥	0.11
<b>Methanol</b>	No BT	¥	4.07	No BT	. ≨	01.0
Mitrobenzene	No BT	¥	0.08	No MT	<b>X</b>	9
Tetrachloroethylene	108	<b>SD</b> C	2	No BT	MA	0.07
Tetrahydrofuran	No BT	×	0.09	No BT	MA	000
Toluene	No BT	KA	90.0	No BT	7	0.0

All test conducted using Gas Chromatograph with photoionization detector No breakthrough detected in three hours **3**29



The Effect of Thickness on Visor Material Permeation Breakthrough Time for Carbon Disulfide and Dichloromethane

Figure 5

dramatically reduces visual clarity.

Optimization of Visor Thickness. Of the commercially available Teflon<sup>R</sup> films, fluorinated ethylene-propylene (FEP) posses, a the highest visible light transmittance per unit thickness and was thus selected as the visor material. The above screening tests were employed to determine the optimum visor film thickness. Data on commercially available 5, 10, 14, and 20-mil FEP film are presented in Table 22. The data reveal that as film thickness increases, the chemical permeation and physical properties improve at the expense of light transmittance (Figure 7). Ten-mil FEP was selected since it provides adequate clarity and resistance to creasing while offering permeation resistance and tear strength consistent with the garment material (Table 15). Additional physical properties of the FEP visor material are offered in Table 23.

Chemical Resistance Testing. Permeation resistance of the 10 mil FEP Visor material was measured against the chemicals in the ASTM F1001 battery as well as other specific chemicals which have permeated Challenge TM 5100. As explained previously, the strategy of this testing was to determine the chemical resistance of the visor material relative to the garment material (Challenge TM 5100). If the chemical resistance was the same or better than the garment material, the Coast Guard could assume that the visor provides as least equivalent protection as the garment and forego the extensive testing done on the garment material. If the latter was not the case, then further testing would be required to determine where differences in chemical resistance occured by essentially testing the same chemicals. Fortunately, in each case the chemical resistance of the visor is better than the garment material as seen in Table 24. Table 25 shows the effects of creasing on the material's chemical resistance for the ASTM F1001 chemicals. Only a slight reduction in permeation resistance was noted with no 'new' chemicals permeating the creased visor material. Complete permeation data and output for visor material testing are presented in Appendix F.

#### Glove Material Selection and Evaluation.

Original Material Selection. The first Coast Guard Chemical Response Suits were designed with Teflon (TFE) inner gloves and outer gloves of either butyl rubber or Viton. The inner glove consisted of two simple hand silhouettes with a peripheral heat-sealed seam. The outer elastomer glove provided the shape to the composite glove, which dramatically improved dexterity, though the overall glove form was relatively less comfortable than typical elastomeric gloves. A testing scheme similar to that used for the visor material was employed to evaluate the selected inner glove material (4 mil Teflon-TFE film). This included testing the chemical permeation resistance of the glove material against the 13 organic chemicals in the ASTM battery to determine performance relative to the garment material. Many of the same physical property tests used to evaluate the garment and visor materials were also performed on the TFE film (Table 23).

Material Testing Results. Physical integrity in terms of tear strength, abrasion resistance, and stiffness were generally poorer than the visor garment material. Lower physical properties of the glove material were believed to be acceptable due to the compromise between offering user

TABLE 22
PHYSICAL PROPERTIES OF FEP FILM VISOR CANDIDATES

Property (Units)	Test Method	5 Mil	10 Mil	14 Mil	20 Mil
Tear Strength <sup>a</sup> Trapezoid Method (1bs)	FED. STD. 191A-5136	8.9	21.5	28.2	20.2
Flexural Rigidity <sup>a</sup> Cantilever Method (mg-cm x 10 <sup>-3</sup> )	ASTM D1388	0-149	1.07	2.85	7.62
Light Transmittance <sup>b</sup> (% Visible)	ASTM E424	95.5	94.8	94.0	92.6
Permeation Breakthrough Time (minutes)	ASTM F739	see Figu	re 6		

<sup>(</sup>a) Average of machine-direction and transverse-direction values

<sup>(</sup>b) Average light transmittance from 390 to 876 nm; Perkin Elmer Lambda 4 Spectrophotometer

# Visor Material Thickness Optimization

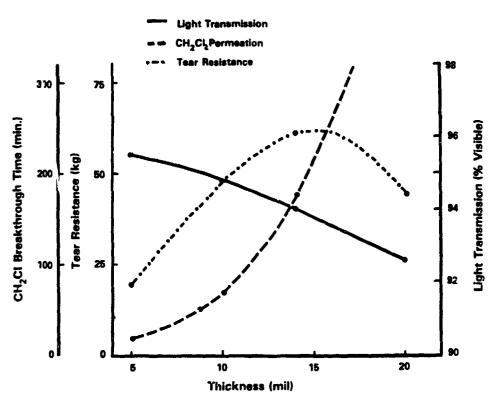


Figure 7

TABLE 23 PHYSICAL PROPERTIES OF VISOR AND GLOVE MATERIALS

Property (Units)	Test Method	Visor	Glave
Composition		Fluorinsted Ethylene- Propylene	Polytetrafluoro- ethylene
Thickness (mil)	ASTM D374	10	4
Tear Strength (1bs) <sup>a</sup> Trapezoid	FED. STD. 191A,5136	21.5	1.9
Abrasion Resistance <sup>b</sup> Taber (gms lost)	ASTM D3389	0.02	0.05
Flexural Rigidity Cantilever (mg-cm)	ASTM D1388	1.07 x 10 <sup>4</sup>	$8.65 \times 10^2$
Low Temperature Bending (°C)	ASTM D2136	Pass at -40°C	Pass at -40°C
Flame Resistance Vertical Char Length (in) After-Flame (sec) After-Glow (sec)	FED. STD. 191A,5903	1.4 0 0	1.5 0 0

 <sup>(</sup>a) Average of machine-direction and transverse-direction valves
 (b) H-18 wheel, 600 cycles, 250 gram weight

TABLE 24

COMPARISON OF PERMEATION BREAKTHROUGH TIMES FOR GARMENT AND VISOR MATERIALS AGAINST SELECTED CHEMICALS

		Garment Material	aterial		Visor Material	erial	
Chemical Name	CERIS	S Breakthrough Time (min)	Perm. Rate (ug/cm2hr)	MDL <sup>8</sup> (PPR)	Breakthrough Time (min)	Perm. Rate (ug/cm <sup>2</sup> hr)	MD' (PPR)
Acetone		No BTb	NA	1.16	No RT	NA.	0
Acetonitrile		No BT	NA	0.60		NA MA	) ·
Acrolten		38-44	1.6-2.4	0.09	THE ON	<b>G</b> 8	
Acrylonitrile		54-76	0.9-5.1	0.24	Not Tested	W	
Allyl Chloride		102-166	0.6-0.7	0.17	No RT	N.	
Carbon Disulfide		18-22	2.6-3.7	0.07	80-06	7 2-13 ¢	00.0
Dichloromethane		47-55	1.0-1.4	0,19	Not Tested	0°CT_C :	0.12
Diethylamine	DEN	No BT	NA	0.15	No BT	N.	1 91
Dimethylformamide		No BT	WA	0.40	No BT	N.	1.21
Ethyl Acetate		No BT	NA	0.49	No BT	N.	0.27
Hexane		No BT	NA	0.25	No BT	¥N.	77.0
Methanol		No BT	NA	4.07	No BT	Y.	1.42
Nitrobenzene		No BT	NA	90.0	No BT	×	0.04
Propylene Oxide		137-170	1.1-1.4	0.80	Not Tested		<u>.</u>
<b>Tetrachloroethylene</b>		108	NDC	2	No BT	KA.	25
Tetrahydrofuran		No BT	WA	0.09	No BT	N.	7 7
<b>Trichloroethylene</b>		143-156	1.5-2.0	0.0	N AT	NA N	
Toluene		No BT	NA N	0.06	N P. T.	N X	77.0
Vinyl Acetate		74-137	3.3-3.7	0.21	NO BT	NA NA	
				1	1	****	?

Minimum detection limit of permeation system for particular chemical No permeation breakthrough detected in 3 hours

**<sup>3</sup>**39

TABLE 25

COMPARISON OF PERMEATION RESISTANCE FOR UNCREASED AND CREASED VISOR MATERIAL<sup>®</sup> SAMPLES

	Uncrease	Uncreased TFE Film		Creased TPE Film	PE Film	
Chemical Name	Breakthrough Time (min)	Perm. Rate (ug/cm <sup>2</sup> hr)	(bbm)	Breakthrough Time (min)	Perm. Rate (ug/cm <sup>2</sup> hr)	MDL (ppm)
Acetone	No BTC	NA	0.07	TH OX	NA.	
Acetonitrile		NA	0.50	No RT	Y N	77.0
Carbon Disulfide		7.3-13.6	0.12	25-3%	MA. 419 0	00.0
Dichloromethane	ited			30-60	2.5-5.2	
Diethylamine				No BT	Na Pa	1.21
Ulmethyllormamide				No BT	WA	1.16
scnyl Acetate	No BT	NA	0.27	No BT	NA	0.14
lexane		NA	0.31	No BT	NA	0.21
Te chanol	1			No BT	NA	1.42
urrobenzene	No BT	NA	0.04	No BT	NA	0.04
retraculoroetnylene				No BT	NA	0.38
letranydroiuran Felici				No BT	NA	1.44
ornene				No BT	NA	0.40

All tests conducted using gas chromatograph with photolonization detector Minimum detection limit of permeation system for particular chemical **3 3 3** 

No breakthrough detected in three hours

dexterity and structural integrity. The chemical resistance of the TFE film was clearly unacceptable, with nearly every chemical tested breaking through the material (Table 26). The quick chemical breakthrough times and high steady state permeation rates are possible evidence of material "microfracturing". These results alone demonstrate that the TFE film was unsuitable as Chemical Response Suit glove material. Complete chemical resistance data is provided in Appendix G.

Interim Glove Material Selections. The Coast Guard was faced with the dilemma of providing gloves for the suit which had comparable chemical resistance as the rest of the garment. The gloves are considered a critical area of protection since chemical exposure to the users at the hands is one of the most likely chemical response hazards. A glove development program with Challenge<sup>TM</sup> materials has begun in August 1987, but in the interim, the Coast Guard decided to employ existing glove material recommendations in the "Guidelines for the Selection of Chemical Protective Clothing" 13 to suggest gloves which would provide adequate chemical resistance for each specific chemical. The results were disappointing. Table 27 gives both the suit and outerglove recommendations. Six different types of gloves are required to cover the range of priority chemicals already tested (Table 28), but for 29 chemicals, no glove recommendations can be made (see Table 29). The reason for these findings are two-fold:

- (1) Many glove materials have not been quantitatively evaluated (via chemical permeation testing with ASTM F739) against enough chemicals; and
- (2) The chemical resistance of Challenge TM 5100 far exceeds that of conventional glove materials.

The consequence of this finding is that the gloves are the weak 'link' in the suit design. While options such as 'double' gloving or awaiting more testing on existing gloves may obviate the problem in the future, there is to data that exist to recommend suit use against certain chemicals, even though the rest of the garment provides adequate protection.

# Suit Seam Design and Testing.

Seam Design. Critical seams of the Coast Guard Chemical Response Suit include:

- (1) Garment Material Garment Material
- (2) Garment Material Visor Material
- (3) Garment Material Inner Glove Material
- (4) Garment Material Suit Closure Tape Material
- (5) Glove Material Glove Material

The individual seam constructions are described in Table 30 and illustrated in Figure 8. Original seam constructions for the garment material to garment material seam involved the combination of sewing in a "T' fashion and heat sealing tape over the sewing holes (Figure 8a). Some seam failures were observed in field testing and Chemical Fabrics Corporation proposed totally heat-sealed seams (Figure 8b). The latter seam demonstrated higher integrity

TABLE 26

PERMEATION RESISTANCE OF INNER G: OVE MATERIAL

AGAINST ASTM F1001 CHEMICALS®

Chemical Name	CHRIS Code	Breakthrough Time (min)	Permeation Rate (ug/cm <sup>2</sup> hr)	MDL (ppm)
Acetone	ACI	2.5	128.9-146.7	0.75-0.89
Acetonitrile	ATN	5.0	57.0-66.0	0.60
Dichloromethane	DCM	2.5	487.1-508.0	2.57-2.60
Diethylamine	DEN	2.5	1072	4.60-4.75
Dimethylformamide	DMF	2.5	38.7-49.2	0.28-0.30
Ethyl Acetate	ETA	2.5	258.2-282.9	0.87-0.90
Hexane	HXA	2.5	1810-1898	9.12-9.68
Methanol	MAL	2.5	15.5-21.8	0.64-0.65
Nitrobenzene	NTB	2.5	56.0-57.8	0.13-0.14
Tetrachloroethylene	PER	2.5	1049-1189	2.78-2.92
Tetrahydrofuran	THF	2.5	1655-1905	8.04-9.57
Toluene	TOL	2.5	(p)	0.39-0.47

<sup>(</sup>a) All tests conducted using a gas chromatograph with photoionization detector in triplicate,—values given represent range of measurments for all three tests

<sup>(</sup>b) Permeation rate exceeded system's capability to measure it

TABLE 27
CHEMICAL RESPONSE SUIT/OUTER GLOVE RECOMMENDATIONS

CHEMICAL	CHRIS CODE	RECOMMENDED	BASIS	RECOMM. OUTER GLOVE MAT'LS.b
Acetaldehyde	<b>AAD</b>	Yes	A	Butyl, Silvershield
Acetic Acid	AAC	Yes	Ā	Neoprene, Nitrile, NNR, Viton
Acetic Anhydride	ACA	Yes	Ā	Butyl
Acetone	ACI	Yes	Ā	Butyl, Silvershield
Acetone Cyanohydrin		Yes	Ā	None Recommended
Acetonitrile	ATN	Yes	Ā	Butyl, PVA, Silvershield, Viton
Acetophenone	ACP	Yes	Ā	None Recommended
Acetyl Chloride	ACE	Yes	Ā	Butyl
Acrolien	ARL	No	Č	
Acrylic Acid	ACR	Yes	Ā	Butyl, Viton
Acrylonitrile	ACN	No	C	
Adipontrile	ADN	Yes	Ă	Not listed in Guidelines
Allyl Alcohol	ALA	Yes	Ā	Butyl, Neoprene, PVC
Allyl Chloride	ALC	Yes	В	None Recommended
Aniline	ANL	Yes	Ā	Butyl, NNR, PVA, Silvershield
Benzene	BNZ	Yes	Ā	Viton, Silvershield
Benzyl Chloride	BCL	Yes	Ā	Viton
Browine	BRX	Yes	Ā	Neoprene
n-Butyl Acctate	BCN	Yes	Ā	Butyl, PVA, Silvershield
n-Butyl Acrylate	BTC	Yes	Ā	None Recommended
n-Butylamine	BAM	Yes	A	None Recommended
n-Butyl Alcohol	BAN	Yes	Ā	Neoprene, Nitrile, Polyethylene
Butyraldehyde	BTR	Yes	A	Butyl
Carbon Disulfide	CBB	Хo	Ĉ	
Carbon Tetrachloride	•	Yes	À	PVA, Silvershield, Viton
Chlordane (25%)	CDN	Yes	Ā	Not listed in Guidelines
Chlordenzene	CRB	Yes	Ā	Viton
Chloroform	CRF	Yes	Ā	PVA, Viton
Chloroicrin	CPL	Yes	Ā	Not listed in Guidelines
Chlorosulfonic Acid	CSA	Yes	Ā	Polyethylene
	CCT	Yes	Ā	Neoprene, Viton
Creosote n-Cresol	CRL	Yes	Ā	Neoprene, Nitrile, NNR
F-Clean	CICL	169	A	Polyethylene
Crotonaldehyde	CTA	Yes	A	Butyl
		Yes	Ā	Not listed in Guidelines
Cumene Hydroperoxide Cyclohexane	CHX	Yes	Ā	Nitrile, Silvershield, Viton
1,2-Dibromoethane	EDB	Yes	Ā	PVA
1,2-Dichlotoethane	EDC	Yes	Ā	Silvershield, Viton
	DEE	Yes	Ā	None Recommended
2,2-Dichloroethyl Ether	DEE	168	A	NOTE VECOMMENTED
Dichloromethane	DCM	No	C	
1,2-Dichloropropane	DPP	Yes	A	PVA, Viton
1,3-Dichloropropene	DPR	Yes	A	PVC, Viton
Diethylamine	DEN	Yes	Ā	Silvershield
Diethanolamine	DEA	Yes	A	Butyl, Neoprene, Viton
Dimethylsufate	DSF	Yes	A	Not listed in Guidelines
Disopropylamine	DIA	Yes	A	Nitrile, Viton
<b>Dimethylformamide</b>	DMF	Yes	A	Buryl, Silvershield

TABLE 27 (Continued)

CHEMICAL RESPONSE SUIT/OUTER GLOVE RECOMMENDATIONS

CHRMICAL	CHRIS CODE	RECOMMENDED	BASIS	RECOMM. OUTER GLOVE MAT'LS.b
1,4-Dioxane	DOX	Yes	A	Butyl, Silvershield
Di-n-Propylamine	DNA	Yes	Ā	Viton
Epichlorohydrin	EPC	Yes	Ā	Butyl
Dimethylsulfate	DSF	Yes	A	Not listed in Guidelines
Disopropylamine	DIA	Yes	A	Nitrile, Viton
Dimethylformamide	DMF	Yes	A	Butyl, Silvershield
1,4-Dioxane	DOX	Yes	A	Butyl, Silvershield
Di-n-Propylamine	DNA	Yes	A	Viton
Epichlorohydrin	EPC	Yes	A	Butyl
Ethion 4	ETO	Yes	A	Not listed in Guidelines
Ethyl Acetate	ETA	Yes	A	Butyl, Silvershield
Ethyl Acrylate	EAC	Yes	A	PVA
Ethyl Alcohol	EAL	Yes	A	Nitrile, NNR, Polyethylene, PVA
Ethylamine (70%)	ram	Yes	A	Butyl, Nitrile
Ethyl Benzene	ETB	Yes	A	Viton
Ethylene Cyanohydrin		Yes	A	Butyl, Neoprene, PVA, Viton
Ethylenedlamine	EDA	Yes	A	Butyl, Neoprene
Ethylene Glycol	EGL	Yes	A	Neoprene, Nitrile, NNR, PVA
Ethyl Ether	RET	Yes	A	PVA, Silvershield
Formaldehyde (37%)	<b>P</b> MS	Yes	A	Butyl, Polyethylene
_				Silvershield, Viton
Furfural	FFA	Yes	A	Butyl, PVA, Silvershield, Viton
Gasoline	GAT	Yes	A	Neoprene, Nitrile, PVA
Glutaraldehyde(sol'		Yes	A	Butyl, Neoprene, PVC, Viton
Hexane	HXA	Yes	A	PVA, Viton, Silvershield
Hydrazine Hydrate	HDZ	Yes	A	Butyl, Neoprene, Nitrile, PVC
Hydrogen Peroxide (30%)	HPC	Yes	A	Nitrile, NNR, Polyethylene, PVA, Viton
Isopropyl Alcohol	IPA	Yes	A	Butyl, Neoprene, Nitrile
<b>Isoprorylamine</b>	IPP	Yes	A	Butyl
Malathion (50%)	MLT	Yes	A	Not listed in Guidelines
Methyl Acrylate	MAM	Yes	A	Butyl, PVA
Methyl Alcohol	MAL	Yes	A	Butyl
Methyl Ethyl Ketone	MEK	Yes	A	Butyl •
Methyl Isobutyl	MIK	Yes	A	PVA
Ketone				
Methyl Isocyanate		No	C	
Methyl Methacrylate	MMM	Yes	A	PVA
Methyl Parathion	MPT	Yes	A	Not listed in Guidelines
Naled	NLD	Yes	A	Not listed in Guidelines
Mapthalene	MLT	Yes	A	Not listed in Guidelines
Nitric Acid	NAC	Yes	A	Neoprene, NNR, Polyethylene, Silvershield, Viton
Nitrobenzene	NTB	Yев	A	PVA, Silvershield, Viton
2-Nitropropane	NPP	Yes	A	Butyl, PVA
Oleum	OLM	Yes	A	Not listed in Guidelines
Parathion	PTO	Yes	A	Not listed in Guidelines

TABLE 27 (Continued)

CHEMICAL RESPONSE SUIT/OUTER GLOVE RECOMMENDATIONS

CHEMICAL	CHRIS CODE	RECOMMENDED	BASIS	RECOMM. OUTER GLOVE MAT'LS. b
Petroleum Ether		Yes	A	Neoprene, Nitrile, PVA
Phenol	PHN	Yes	A	NNR, Polyethylene
Phosphoric Acid	PAC	Yes	A	Neoprene, Nitrile,
•				Polyethylene, PVC
Phosphorous Oxychloride	PPO	Yes	A	None Recommended
Phosphorous Trichloride	PPT	Yes	A	None Recommended
Polychlorinated Biphenyls	PCB	Yes	A	Neoprene, Silvershield, Viton
Proplonic Acid	PNA	Yes	A	None Recommended
n-Propyl Alcohol	PAL	Yes	A	Neoprene, Nitrile
n-Propylamine	PRA	Yes	A	Butyl, Neoprene
Propylene Oxide	POX	Yes	В	Butyl
Silicon Tetrachlorid	e STC	Yes	A	Not listed in Guidelines
Sodium Hydrosulfide	SHR	Yes	A	Not listed in Guidelines
Sodium Hydroxide	CSS	Yes	A	Butyl, Neoprene, Nitrile, NNR, Polyethylene, PVC, Silvershield, Viton
Styrene	STR	Yes	A	PVA
Sulfur Monochloride	SFM	Yes	Ā	None Recommended
Sulfuric Acid (95%)	SFA	Yes	Ā	NNR, Polyethylene, Silvershield, Viton
1,1,2,2-Tetrachloro- ethane	TEO	Yes	A	PVA, Viton
Tetrachloroethylene	TTE	Yes	В	Silvershield, Viton
Tetrahydrofuran	TÇE	Yes	A	None Recommended
1,1,1-Trichloroethan	e TCL	Yes	A	PVA, Silvershield, Viton
Trichloroethylene	TCE	Yes	В	Silvershield, Viton
Toluene	TOL	Yes	A	Silvershield, Viton
o-Toluidine	TLI	Yes	A	None Recommended
Toluene-2,4- Disocyanate	TDI	Yes	A	Butyl, Nitrile, Polyethylene, PVA, Silvershield, Viton
Turpentine	TPT	Yes	A	PVA
Vinyl Acetate	MAV	Yes	В	None Recommended
Vinylidene Chloride	VCI	Yes	A	PVA
Xylenes	XLM	Yes	A	Viton
Xylenol	XYL	Yes	A	Not listed in Guidelines

aBasis of Recommendation:

A - No breakthrough in three hours - RECOMMENDED

B - No breakthrough in one hour, but breakthrough time occurs before three hours - RECOMMENDED

C - Breakthrough occur within one hour - NOT RECOMMENDED

### TABLE 27 (Continued)

# CHEMICAL RESPONSE SUIT/OUTER GLOVE RECOMMENDATIONS

bOuterglove Recommendations based on quantitative recommendations provided in the 3rd Edition of "Guidelines for the Selection of Chemical Protective Clothing" (reference 13). Material abbreviations: PVA - Polyvinyl Alcohol, PVC - Polyvinyl Chloride, NNR - Neoprene and Natural Eubber.
\*\*\*CAUTION: End users should check with vendor for specific recommendations on selected glove.

TABLE 28

### SUMMARY OF OUTERGLOVE MATERIAL RECOMMENDATIONS

No. Materials Recommended	No. Chemicals
3 or more materials	26
2	27
1	25
No materials recommended	13
Not in selection guidelines	16
No recommendations possible	_5
TOTAL	112

#### TABLE 29

### AVAILABLE GLOVE MATERIALS

Material	No. Recom	endations <sup>a</sup>
Butyl Rubber	28	
Neoprene	19	
Neoprene/Natural Rubber	10	(P)
Nitrile	17	(P)
Polyethylene	12	
Polyvinyl Alcohol	26	
	6	(b)
Polyvinyl Chloride Silvershield <sup>TM</sup>	27	(0)
VitonR	29	

<sup>(</sup>a) Recommendations based on quantitative measures indicating adequate protection greater than 1 hour.

<sup>(</sup>b) Not needed in CRS outerglove system due to other gloves providing adequate protection

#### TABLE 30

#### DESCRIPTION OF SUIT SEAM CONSTRUCTIONS

Garment Katerial Seam:

(original construction)

sewn, then heat sealed with 5-6 mil Teflon
tape over seam assembly on both sides
(Figure 8a)

Garment Material Seam: new suit seams 1/2 inch ho

rment Material Seam: new suit seams 1/2 inch heat sealed lap (new construction) seams with tape over seam assembly on both

sides (Figure 8b)

Garment-Visor Mat'l Seam: heat sealed with 5-6 mil Teflon tape over

seam assembly on both sides

Garment-Closure Seam: fiberglass heat sealed to garment

material; zipper neoprene tape sewn and bonded to fiberglass with toluene based

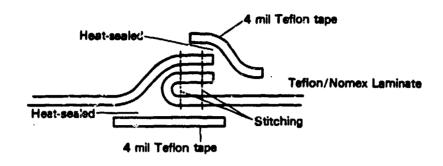
adhesive (Figure 8c)

, Garment-Inner Glove Seam: fiberglass heat sealed to garment material

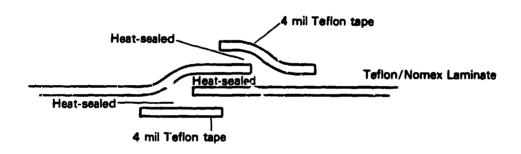
(Original construction) at sleeve end; fiberglass bonded to plastic glove ring and inner glove

Garment-Inner Glove Seam: Attached with butyl elastic band and (new construction) stainless steel hose clamp

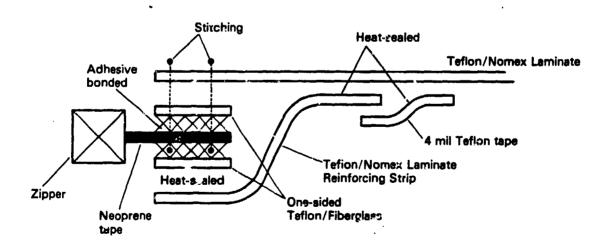
Glove Material Seam: 1/4 inch heat sealed lap seam



## (a) Original Garment Material Seam



#### (b) New Garment Material Seam



### (c) Garment Material-Closure Tape Seam Assembly

Seam Constructions

Figure 8

and fewer seam failures were noted in field tests where significant physical abuse of the suits occurred. Table 31 presents data for three different garment seams, of which the 1/2 lap seam was chosen due to its physical strength and ease of implementation into the suit design. Garment material interfaces with non-Teflon materials presented a problem in heat sealing. The attachment of the suit visor could be done directly by heat sealing but required some adjustments in the heat sealing procedure. The neoprene closure (zipper) tape could not be heat sealed and required using a fiberglass interface between the Teflon and the neoprene tape; the fiberglass was heat sealed to the Teflon laminate and the neoprene tape was both stitched and bonded to the fiberglass section (Figure 9c).

Seam Physical Integrity Testing. Each of the seam constructions have been subjected to two types of seam strength tests: tensile and dead load stresses (Table 32). The ultimate tensile strength of each seam type generally reflects the tensile strength of the weakest base material, as opposed to the actual strength of the heat-sealed joint. In other words, the heat sealed seams are designed to be as strong or stronger than the base materials (with the possible exception of the glove-glove seam which exhibited both film and seam type failures). Dead load or creep testing was conducted to simulate the long term but low stress conditions resulting from the positive pressure in a totally encapsulating suit. Representative seam stresses were calculated for two locations within the suit (torso and glove) based on a internal positive pressure of 5.7 mm Hg and on measured suit dimensions. Dead load testing was conducted at loads for the glove and torso repsectively. No failures occurred in any of the seam configurations in 48 hours under the above loading conditions.

Seam Chemical Resistance Testing. Penetration testing (ASTM F903) of the first three seams was conducted by Anderson Associations for the Coast Guard R&D Center against a five chemical battery (water, hexane, toluene, methyl ethyl ketone, and hydrochloric acid). No penetration was noted for any seam-chemical combination. Appendix H is a copy of the contractor's report. Attempts were made to measure seam permeation testing with the standard ASTM method but anomolous results have been observed. The non-homogeneous surface of the seam may have caused leakage in the test cell; this may explain the relatively short breakthrough times compared to what is expected for seam performance. Placement of a solid sheet material between the seamed material and the collection chamber gave no breakthrough. Use of successively more compressible gaskets also gave longer breakthrough times as confirmed by both the Coast Guard R&D Center and Texas Research Institute (Table 33; other data in Appendix I). The use of a 1/4" expanded PTFE (polytetrafluoroethylene) was the only gasket arrangement which provided the expected results. At the time this report was prepared (July 1987), additional seam permeation test was in progress against the ASTM F1001 chemicals and other chemicals which permeated the garment material (Table 18).

#### Selection and Testing of Other Suit Components.

Suit Closure Selection. The Coast Guard could not identify suit closures constructed of Teflon<sup>R</sup> (or other highly chemically resistance materials) which also provided an airtight seal. Past Coast Guard suit designs employed pressure sealing sippers, two-track closures (like Ziplock<sup>R</sup>), or the

TABLE 31
OPTIMIZATION OF GARMENT SEAM TYPES®

Seam Type	Direction of Separation	Fabric Stress at Failure (lb/in)	Mode of Failure
"T" Sewn/Heat-sealed	Warp	51.5	Stitching <sup>b</sup>
	F.11	49.9	Stitching
1/2" Heat-sealed Lap	Warp	95.0	Adhesion <sup>C</sup>
	Fill	75.0	Adhesion
3/4" Heat-sealed Lap	Warp	110.0	Adhesion
	Fill	88.0	Adhesion

<sup>(</sup>a) Optimization determined by seam tensile strength testing. Tests were performed using a a modified form of ASTM D751-79; Samples sizes were 1" x 12", with seam down long sample axis; a 0.2 in/min rate of separation was used.

<sup>(</sup>b) Stitching failures involve seam separation at stitched areas

<sup>(</sup>c) Adhesion failure involve either delamination of coating from the fabric or the breakdown of the bonding in the lap seam

TABLE 32
SLIT SEAM PHYSICAL PROPERTIES

Seam Type	Ultimate Tensile Strength (lbs/in)	Dead Load <sup>a</sup> (1bs/in)	Test <sup>b</sup> Duration (hr)
Challenge-Challenge (heat-sealed seam)	132	15	48 <del>+</del>
Challenge-Visor	25.3	15	48 <del>+</del>
Challenge-Closure <sup>C</sup>	129.5	15	48+
Challenge-Glove	12.3	2.3	48+
Glove-Glove	8.2	2.3	48+

<sup>(</sup>a) Dead loads were conducted at approximately 15 times the static seam stress resulting from normal suit positive pressure (3.0 in Water).

Maximum interior dimensions of 10.2 in radius in the suit torso and 2.9 in. radius in the glove yield stresses of 0.15 lbs/in respectively.

<sup>(</sup>b) n+ indicates no failure in the time stated.

<sup>(</sup>c) Closure is a neoprene-brass pressure sealing zipper.

TABLE 33

PERMEATION TESTING R. SULTS FOR VAKIOUS GARMENT MATERIAL SEAM TESTS AGAINST ETHYL ACETATE

Run	Gasket Type (Number)	Breakthrough Time(min)
A	Reoprene (2)	6
В	Neoprene (1) Teflon (2)	7.5
<b>C</b>	Neoprene (2) Teflon (2)	96
D	1/4" Expanded PTFE Cord	3 Hrs

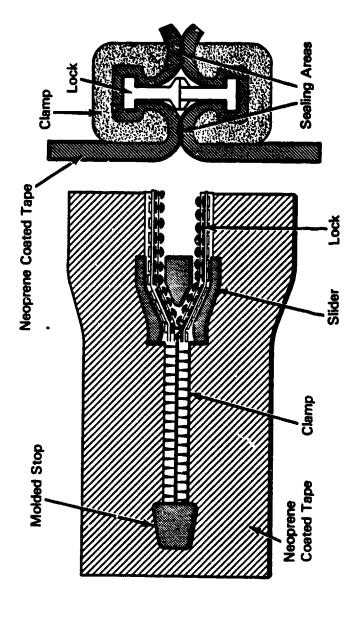
combination of the two.<sup>3</sup> Two-track closures can only be fabricated from plastics with the appropriate physical characteristics (i.e., polyethylene and CPE). Pressure sealing zippers operate with the zipper chain (clamp and lock) compressing the two sides of the coated tape together to form an air-tight seal (Figure 9). These zippers are typically used in diving dry suit applications and are fabricated from neoprene (tape) and brass alloys (clamp, lock, and slider). While other metal components are available (e.g. stainless steel), neoprene is the only coated tape used in the manufacture of these closures. Therefore, both types of closures consist of materials with relatively lower chemical resistance compared to the garment material. The Coast Guard picked a Talon OEBR pressure sealing zipper over two-track closures due to its better field performance and air-tight qualities. In order to protect the closure from chemical exposure, the zipper was placed in the rear of the suit and enclosed in a protective cofferdam described in Chapter 5.

Suit Exhaust Valve Selection. Totally-encapsulating chemical protective suits use low-pressure one-way vent valves to allow the escape of exhaust air from the wearer's self-contained breathing apparatus, and to maintain a small positive pressure (1 to 3 inches water column pressure) inside the suit. latter feature minimizes diffusion or penetration of chemical vapors through poor seams, material punctures, or improperly closed zippers. Satisfactory operation of these valves is critical to the functional and protective qualities of the suit. In earlier suit designs, the Coast Guard used four Halkey Roberts (#780-RPA.1) valves. Though these valves offered adequate performance, they were no longer available for production of the Coast Guard Chemical Response Suit. The Coast Guard identified an alternative valve, the Stratotech P/N 739-2.5 with a 'cracking pressure' of 2.5 inches water column pressure (illustrated in Figure 10). Like other valves, the sealing components are fabricated materials with relatively low chemical resistance. In this case, a silicone rubber valve 0-ring seals against the valve body (aluminum). The Coast Guard principal concerns for these valves are:

- (1) providing adequate venting of the suit (to prevent overpressurization which limits user mobility and stresses suit seams),
- (2) resisting chemical degradation of the valve sealing surface, and
- (3) resisting 'backflow' while the valve is operating.

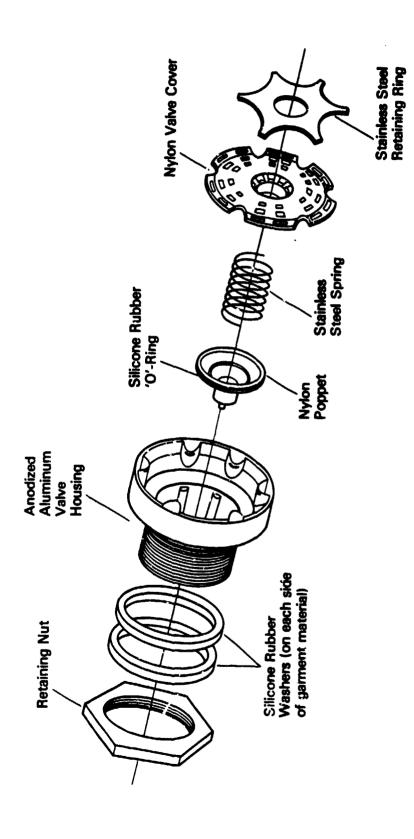
Valve flow rates at different levels of wearer work were measured in manned laboratory tests described in Chapter 5. Attempts at measuring the two other phenomena are discussed below. The valves are partially protected by an inverted pocket to prevent direct liquid chemical impingement.

Closure and Exhaust Valve Testing. Measurement of closure and exhaust valve performance with respect to chemical exposure is difficult to assess since they are not sheet-like materials and standard methods do not exist to measure their chemical resistance. Penetration testing of the suit zipper has been performed using a modified test cell against the five chemical penetration battery with no evidence of penetration as reported in Appendix H. Sample suit zippers have also been subjected to zipper crosswise strength testing to determine tensile properties relative to the garment material. All suit zippers far exceed the Coast Guard requirement of 50 lbs/in. crosswise strength (90 lbs/in.). The Coast Guard intends to measure other closure physical properties such as bursting strength for evaluating suit closure



Suit Closure Design (Courtesy, Talon, Inc.)

Figure 9



Suft Exhaust Valve Design

Pfgure 10

performance once methods are developed. An initial assessment of suit exhaust valve performance was conducted by Lawrence Livermore National Laboratory in a separate Coast Guard sponsored investigation. The study attempted to measure valve resistance to backflow and tried to clearly establish valve performance characteristics. The results reported in Appendix J are unconclusive. While leak rates for a number of valves including the Stratotech valve were quantitatively defined, the significance of these rates must be still determined. An additional study was begun in June 1987 to answer the following questions:

- (1) What is the effect of valve configuation on valve leak rate?;
- (2) Is the leak rate of the valve proportional to outside chemical concentration?; and
- (3) How do exhaust valve covers (or protective pockets) influence valve leak rate?

Once this study is completed, additional work will be undertaken to examine changes in valve performance following chemical vapor exposure.

#### Integration of Test Data.

The results from material chemical resistance and physical property testing must be related to overall suit performance in order to provide meaningful results to end-users. Physical property data are used to determine if materials and components possess sufficient integrity and resistance to physical/environmental abuse relative to evolving standards. Generally, each material should have similar physical property requirements, but these may differ based on the material's function. Such requirements should be set to reflect actual use conditions. While standards have been used in the past based on Chemical Warfare clothing material requirements, the Coast Guard is conducting new studies to better define which properties should be measured and what are reasonable requirements for those properties.

Using chemical resistance data to assess suit performance is a much more complex problem. Because dermal exposure limits don't exist, any permeation of hazardous chemicals through a protective garment is considered unacceptable. The problem arises in comparing material swatch testing against overall suit exposure to chemicals. In general, most permeation resistance testing represents "worst case" exposure, where the liquid or gaseous chemical is in constant contact with the material over the length of the test period. This is not the usual case for field exposures during spill response and monitoring. Yet, many researchers recognize that certain variables (i.e., temperature, chemical mixtures) can accelerate a chemical's effect on materials. This combined with the inability to test any material-chemical combination under all conditions makes the establishment of suit recommendations difficult.

The Coast Guard has adopted a one-hour criterion for permeation breakthrough time for initially recommending suit use against a particular chemical. One hour should provide a reasonable safety factor for all anticipated exposures. However, this rule is being applied to all primary materials and components, i.e., the recommendation is based on the performance of all primary materials (garment, visor, and glove). These recommendations

appear back in Table 27. Mixture testing was initiated August 1987 to determine if synergistic permeation is observed. If this is not the case, then performance of the garment can be judged on the basis of individual mixture component permeation results. Otherwise, predictive models and field test kits will be required to determine the safety of suit use on a case-by-case basis. Predictive models may also be applied, once developed, to different conditions of exposure such as temperature and chemical concentration.

#### CHAPTER 5

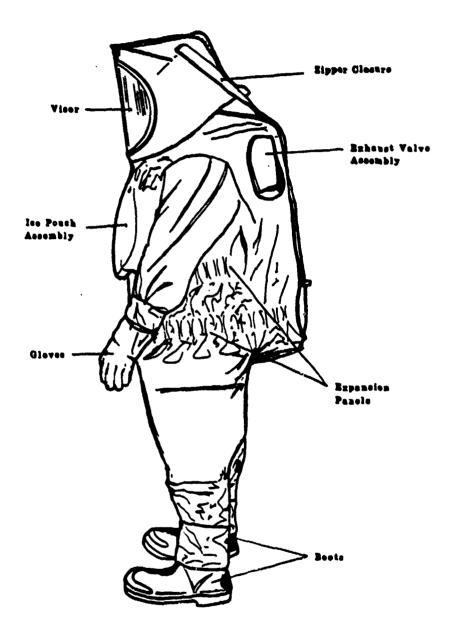
#### SUIT DESIGN AND OVERALL SUIT TESTING

The Coast Guard was able to capitalize on earlier development efforts for both designing the Chemical Response Suit and testing its overall performance. The original design of the VitonR/chlorobutyl chemical response suit served as the basis for specfications to construct new suits made of Challenge TM 5100. Likewise, shortcomings of the protection factor and physiological testing conducted on early suit prototypes (described in reference 3), were identified and used to improve test methods to assess overall suit performance. Suit design and testing has been an evolving and iterative process. Through development to deployment, a number of successive suit designs were considered with each new improvement identified through testing. Overall testing has been critical to understand the capabilities and limitations of the Chemical Response Suit. Material and component testing by itself cannot identify all problems, particularly in terms of configuration, fit, comfort, function, and the overall protection offered the ensemble (the suit in combination with the respiratory apparatus and other auxiliary equipment).

#### Suit Design.

Basic Configuration. The configuration of the Chemical Response Suit was based on the original design for suit prototypes constructed from Viton (chlorobutyl laminate. However, a number of changes have been made to either accomodate the ChallengeTM material or improve the comfort and suit fit to the user. Some patterning changes took place for the use of heat-sealed seams versus the combined heat-sealed and sewn seams used in earlier suit constructions. Other changes included modification of the hood and torso areas for better integration with the breathing apparatus and to provide greater visibility out of the visor, especially for shorter people. As before, sizing of the suit was based on a single size using data for the 95 percentile person (male) obtained from the U.S. Army. In general, the suit as designed fits people from heights of 5'8" to 6'4". Smaller subjects have more difficulty with sleeve and trouser leg length. Figure 11 shows the original suit design, whereas the most recent design is illustrated in Figure 12. The entire suit less the cooling pouch and heat exchanger weighs approximately 9 pounds.

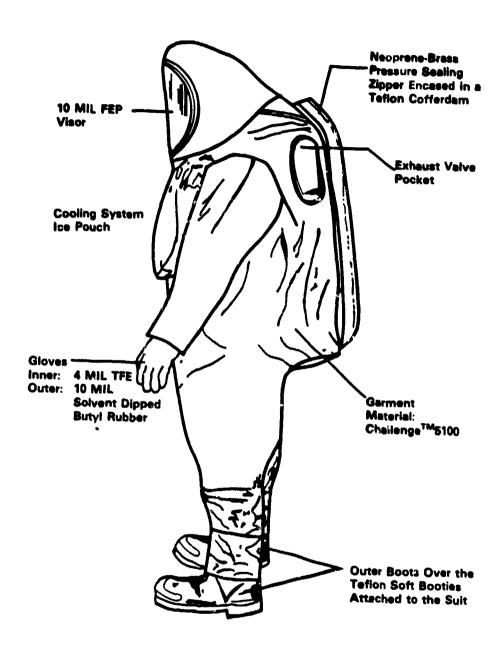
Suit Cofferdam The suit closure, a pressure-sealing zipper is considered one of the weak areas on the suit because of the relatively poor chemical resistance of the materials (neoprene, brass) used in its construction. A cofferdam was designed as part of the Chemical Response Suit to prevent permeation and penetration of chemical vapors or liquid splashes. The cofferdam consists of two long rectangular pieces of Challenge 5100 heat sealed to the garment wall along both sides of the closure. These two pieces of material flaps extend approximately six inches from the wall of the garment material, and can be heat-sealed using a portable, modified Doboy heat sealer (Metric Model HS-C). The heat-sealer is used to temporarily seal the outer edges of the material flaps resulting in a vapor tight seal that provides



## TOTAL ENCAPSULATING SUIT DESIGN

(Original)

Figure 11



Current Chemical Response Suit Design

Figure 12

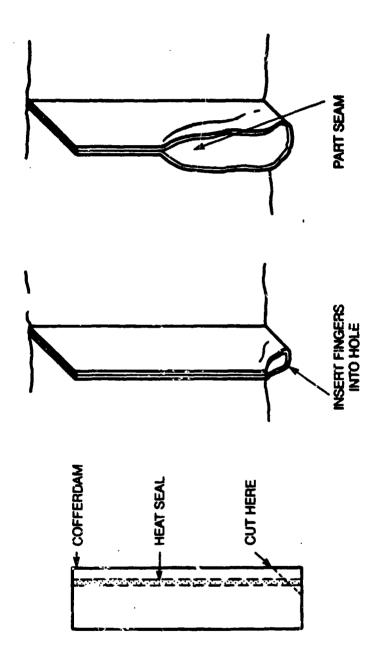
equivalent chemical resistance as the garment material and complete protection to the suit wearer. Doffing of the suit is accomplished by cutting a small polition of the cofferdam away and then separating the heat-seal by simply pulling the flaps apart (see Figure 13). The outer edge of the flaps are long enough such that the heat-sealed portion of the flaps may be cut away 3 to 6 times for reusing the suit (\*\*CAUTION: Reuse of the Chemical Response Suit is only permitted under certain circumstances at the discretion of the On-scene commander for the chemical incident).

Integration with Auxiliary Equipment Consistent with previous Coast Guard chemical protective suit prototypes, the Chemical Response Suit was designed for flexibility in accomodating different types of auxiliary equipment, principally breathing apparatuses. The rear of the suit is expanded (see Figure 12) to allow the wearer to use a NIOSH approved, self-contained breathing apparatus (SCBA) with a 60 minute-rated bottle. The Coast Guard uses 60 minute SCBA's as standard equipment for hazardous chemical response. These types of SCBA's are somewhat larger than the conventional SCBA's and allowances must be made in the suit design for their use. Other features of the Chemical Response Suit impact this choice of respiratory protective equipment. For example, the attachment of the gloves to the glove rings lets a user remove his hands from the garment sleeve and adjust his or her breathing apparatus, if needed. Also, one reason for locating the closure in the rear of the suit was to allow easier exchange of SCBA air bottles for extended missions.

The cooling garment developed for earlier suit prototypes (described in reference 3) was adopted for use with early versions of the Chemical Response Suit. The cooling system consists of a separate full body garment which has 'cooling' panels on the front and back of the upper torso and thighs. Cold water is circulated through these panels, absorbs body heat and is returned to a heat exchanger built onto the front of the Chemical Response Suit. An ice water slurry is used to cool the water which returns to the cooling garment via small battery driven centrifugal pump. This system is illustrated in Figures 14, 15, and 16. When deployed, the additional weight of the system including water and ice is approximately 12 pounds, more than doubling the weight of the suit. The effectiveness of the cooling system in preventing heat stress has not been fully determined. Some suit wearers have expressed that they feel 'cool' when wearing the system. However, the additional weight of the system, plus the reduction in mobility from the incorporation of this equipment, add to the physiological strain on the suit wearer. As a consequence, more recently ordered Chemical Response Suits have been fabricated without the cooling pouch and heat exchanger. A study was initiated in June 1987 to fully investigate the Coast Guard cooling system's effectiveness relative to other cooling devices worn with the Chemical Response Suit. The results of these tests will compared for test subjects wearing the suit without any cooling system. This investigation is being conducted in conjuction with the National Institute for Occupational Safety and Health (NIOSH).

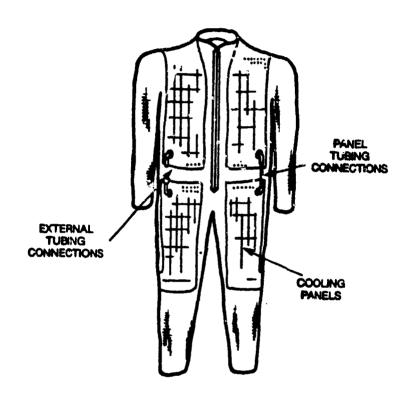
Other clothing or equipment that can be worn with the Chemical Response Suit include Nomex jumpsuits, Tyvek<sup>R</sup> disposable suits, communications systems, and heart rate monitors. Tyvek<sup>R</sup> disposable suits are worn underneath the Chemical Response Suit to reduce the likelihood of wearer contamination during gross suit decontamination (to allow doffing of the suit

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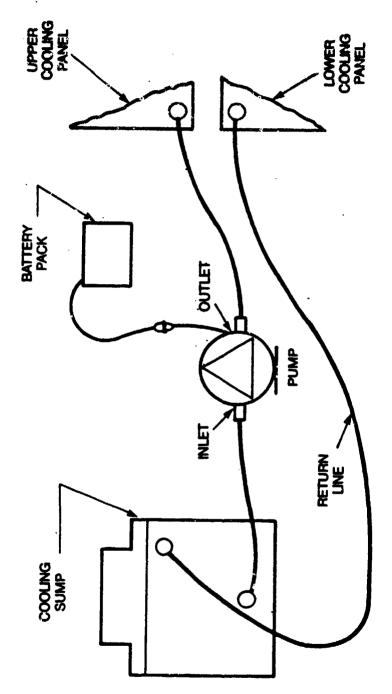
Opening a Suit Cofferdam

Figure 13



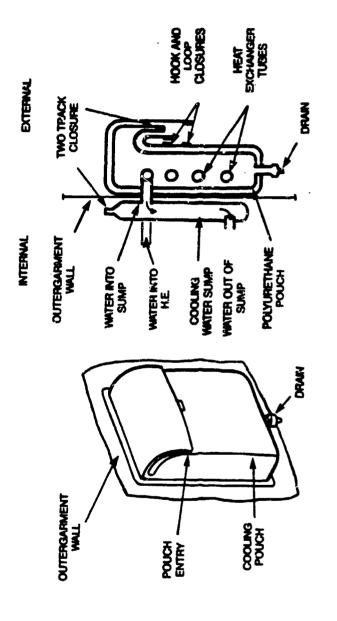
Full Body Cooling Garment

Figure 14



COOLING SYSTEM WIRE AND HOSE ROUTING

Figure 15



# COO! ING POUCH AND HEAT EXCHANGER DESIGN

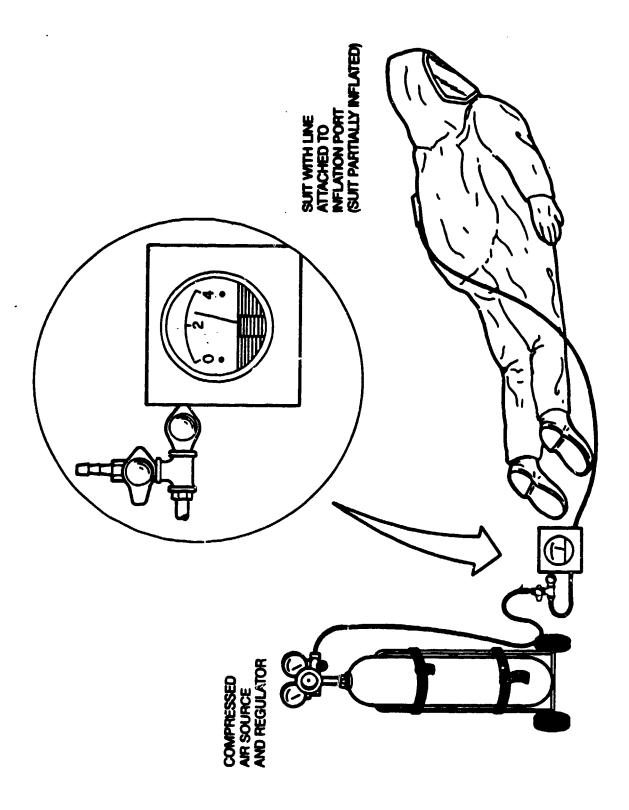
Figure 16

by the wearer). Nonex jumpsuits can be worn underneath the suit to minimize the hazards of flashover or contact with fire. Equipment items including communications systems or heart rate monitors vary widery, but in general their selection is dependent on how well they integrate with both the Chemical Response Suit and the SCBA. Remic Corporation developed a communications system which is usable with all types oil chemical protective clothing. 22 Their development investigated several considerations for the design and selection of communication devices in hazardous chemical response.

#### Overall Suit Testing.

Pressure Testing. The most widely used methods for assessing chemical protective suit integrity involve the practice of inflating the suit to determine leakage. Pressure testing was used to measure the integrity of all Coast Guard Chemical Response Suit Tests following fabrication by both the manufacturer and the recepient Strike Team. This method rests the suit and visor materials, suit seams, and suit closure for gas-tightness. In the test, the suit is inflated to a specified pressure and either the pressure drop is measured over time, or a soap solution is applied to the outside of the suit for observing the appearance of bubbles (to detect leaks). The suit exhaust valves must be closed (or plugged) to perform the test, and a pressure gauge is attached with a special fixture that replaces one of the suit exhaust valves. ASTM F1052 specifies a maximum inflation pressure (3 inches water gauge), a test pressure (2 inches water gauge), and an allowable pressure drop (20%) over a three minute period. 23 It also requires using the soap solution to locate leaks if the suit does not meet the pass/fail criteria. The Coast Guard used this method but specified higher maximum inflation and test pressures (4" and 3" water gauge, respectively). The method is illustrated in Figure 17 and was found very sensitive to small leaks in the garment.

Quantitative Leak Testing Qualitative leak testing was used to measure the integrity of the entire Chemical Response Suit to both a gaseous and aerosal challenge agent in a manner simulating actual use. This testing involved the exposure of a test subject wearing the suit and a self-contained breathing apparatus in a closed chamber, while measuring the challenge agent concentrations both inside and outside the suit. The ratio of the external and internal challenge agent concentrations is known as the "intrusion coefficent". Large coefficients indicate high suit integrity. During the exposure, the test subject also engaged in a series of exercises to test the suit under dynamic conditions. Lawrence Livermore National Laboratory tested several Coast Guard suit prototypes using both Freon and polyethylene glycol (PEG) aerosol as challenge agents. The analytical equipment for measuring Freon (an infrared spectrometer for high concentrations and a flame ionization gas chromatograph for low concentrations) could measure a larger range of concentration than the light scattering photometer used to measure PEG concentrations. As a consequence, it was possible to measure larger intrusion coefficients for Freon. On the other hand, Freon concentration could only be measured dicretely whereas the PEG aerosol was continuously monitored. For the combined tests, instrusion coefficients ranging from 9,000 to 100,000 were measured. Variations in these determinations appeared to be the result of specific test subject exercises and the location of the sampling probe. For example, when the sample probe was located inside the suit near the exhaust



Pressure Testing of Chemical Response Suit

Figure 17

valve, lower protection factors were observed indicating some diffusion of the chemical agent through the valves. Lawrence Livermore National Laboratory also measured internal suit pressure during these tests to assess the range of positive pressure experienced in the suit during operation. These latter results were used to identify overpressurization problems with the selected exhaust valves which were later corrected. Additional information and the results of this testing are provided in the attached Lawrence Livermore Report (Appendix K).

Simulated Chemical Exposure. An ultimate test of the Coast Guard's Chemical Response Suit was performed by Lawrence Livermore National Laboratory in a hostile chemical environment. Two prototype suits were field tested at the Department of Energy's Nevada Test Site in controlled releases of hydrogen fluoride. These suits were placed on specially designed mannequins in two separate tests and subjected to hydrogen fluoride vapor concentrations up to 12,000 ppm for a 6 minute period. The mannequins contained a pulsed breathing air supply to simulate normal operation of the suit's exhaust valves and four different hydrogen fluoride detection systems. The analytical results of the two tests indicated no penetration of hydrogen fluoride into the suit. There was also no evidence of visible damage to the contaminated suits. A Lawrence Livermore National Laboratory Report on this testing is provided as Appendix L.

Manned Functionality Testing. The Coast Guard conducted several informal manned tests of the Chemical Response Suit to assess ensemble comfort, fit, and function. Manned suit testing is often performed to determine the range of activities that a user can do while wearing the chemical protective suit and a breathing apparatus. These tests included different types of exercises or tasks which simulated the use of the Chemical Response Suit. Results from these tests were generally subjective regarding the design and fit of the garment. A number of improvements were identified for changing various features of the Chemical Response Suit. In one series of tests, the wearer's physiological condition (core temperature, skin temperature, heart rate, and blood pressure) were measured during testing to serve as a means for quantifying the physical stress on the wearer when compared to the same tests of the subject not wearing the suit. This study was also aimed at identifying parameters that could be easily measured in the field for evaluating worker condition to prevent heat stress. The most promising heat stress indicator found was the recovery heart rate, i.e, the measurement of heart rate following a period of rest. The results of these tests are reported in Coast Guard Final Report, "The Measurement of Heat Strain for Workers in Encapsulating, Impermeable Protective Clothing."24

#### Suit Operations

Use of Encapsulating Garments The Chemical Response Suit is the U. S. Coast Guard's Level A suit for hazardous chemical operations where no contact with a chemical or group of chemicals is permitted. These suits are therefore used when the chemical involved in a response includes high respiratory and skin absorption hazards. The criteria for selecting the Chemical Response Suit for level A protection are described in the Coast Guard's "Policy Guidance for Response to Hazardous Chemical Releases and reference 27. The Coast Guard considers the Chemical Response Suit a 'one-use' suit, i.e., the suit is disposed of if it receives any significant

chemical exposure. Significant exposure is defined by the on-scene commander for a particular chemical incident. Yet in general, if the suit is worn into an environment where measureable chemical vapors are present, or if the suit is splashed by liquid chemicals, or if an exposure cannot be determined the suit will not be reused. The basis for this policy rests in the fact that no non-destructive methods exist for determining the level of contamination a suit receives nor the effectiveness of any decontamination procedure. Other invesigators have demonstrated that chemical protective suit materials are contaminated below the surface which may render many conventional decontamination methods useless. 28

General Suit Use The Coast Guard Office of Engineering and Development has prepared a suit operations manual listing procedures for donning, doffing and maintaining the suit. This manual is specific for the use of the Chemical Response Suit and dictates step-by-step procedures and backgound information pertinent to using the suit.

#### CHAPTER 6

#### CONCLUSIONS AND FUTURE PLANS

This report has described an extensive suit material/component testing program to support the Coast Guard's use of Challenge<sup>TM</sup> in their Chemical Response Suit. The program represents a comprehensive approach for selecting materials and evaluating their performance for chemical spill response and clean-up. Moreover, this type evaluation allows end-users to understand suit capabilities and limitations. The Coast Guard believes that the new material, Challenge<sup>TM</sup> 5100, will provide protection for more chemicals than any one suit or combination of suits it now uses. Few chemical protective suits offer the same level of documentation. It appears, however, that all primary suit materials and components should be tested to identify weaknesses that might otherwise go undetected. This situation was observed with the failure of the Teflon glove materials. Garment material performance alone does not provide a sufficient basis for making suit use recommendations. Recommendations for using the suits must be based on the performance of the weakest material or component.

Despite the extensive material testing conducted thus far, a number of other tests are required for establishing complete confidence in using the Chemical Response Suit. At the time this report was being prepared, several types of testing were underway; these included:

- (1) Permeation Testing of Challenge TM 5100 against priority chemical gases;
- (2) Additional permeation tests on Chemical Response Suit seams;
- (3) Permeation testing of Challenge<sup>TM</sup> 5200 (a Teflon/fiberglass material) against ASTM F1001 Chemicals plus those chemicals which break through Challenge<sup>TM</sup> 5100. Preliminary results from Chemical Fabrics Corporation indicate that Challenge<sup>TM</sup> 5200 may have increased physical integrity and chemical resistance;
- (4) Permeation testing of promising outerglove materials such as Siebe-North's Silvershield magainst representative chemicals; and
- (5) Exhaust valve testing against various chemical atmospheres

In August 1987, the Coast Guard plans to initiate a new contract for material permeation testing against a large number of chemicals to expand the list of suit use recommendations. As before, the majority of these chemicals will be selected on the basis of their spill history and toxicity using more recent chemical data. Some of the chemicals will be chosen for modelling purposes, i.e., to help determine why some chemicals permeate the material while other similiar chemicals do not (e.g. allyl chloride versus allyl alcohol). The latter testing will be used to study the chemical interactions with Challenge TM 5100 to determine which chemical parameters may be used to predict material performance.

The overall design process for the Chemical Response Suit has been iterative. Successive changes in suit design have increased the comfort, fit, and function of the suit. However, some areas require improvement, as recommended by field units using the suit. Among these are:

- (1) Expanding the boot splash cuff to allow wearers to move easily in outer boots; More recent versions of the Chemical Response Suit have been made with elasticized cuffs which may solve this particular problem.
- (2) Bliminating the cooling system and replacement with a lighter, more functional cooling device; The current cooling system is heavy, reduces mobility, and is difficult to don. A new study has been initiated to evaluate the effectiveness of the current cooling system relative to other commercial cooling devices. The recommendations from this investigation will be used in concidering modifications to the Chemical Response Suit.

- (3) Developing Teflon/Nomex gloves; The Coast Guard will attempt to develop gloves made out of similiar materials as those used in the garment. The gloves remain a principal area of weakness in the Chemical Response Suit. Successful development of such gloves would eliminate glove selection problems and provide uniform chemical resistancs to the wearer.
- (4) Investigating alternatives to the cofferdam; Though the cofferdam provides equivalent protection to the user at the closure area, it can be difficult to heat-seal in a field setting. The alternative of a double sipper may be examined and tested to determine if this protective feature permeation or penetration of the suit closure.
- (5) Examining other suit exhaust values; The current Stratotech values have a relatively high cracking pressure (2.5 inches water gauge). Tests at Lawrence Livermore National Laboratory have shown that pressures fluctuate within Chemical Response Suit from 0.1 to 8.0 inches water gauge. The suit manufacturer, Chemical Fabrics Corporation, has identified an alternative valve which has both a lower cracking pressure and high flow volume. Further testing of this valve is being conducted by Lawrence Livermore National Laboratory.
- (6) Considering suit sizing; The "one wize fits all" concept makes suit fit difficult for the range of Coast Guard personnel who must wear the Chemical Response Suit. The Coast Guard will investigate the possibility of a two or three size suit system in its future procurement of Chemical Response Suits.

The U. S. Coast Guard is actively participating in the development of consensus standards for chemical protective clothing in both the American Society for Testing and Materials (ASTM) and the National Fire Protection Association (NFPA). The latter organization is developing performance standards which will apply to the manufacturing of chemical protective suits. The Coast Guard hopes to transfer much of the testing technology it has developed into these standards. If this process is successful, the Coast

Guard will benefit by being able to use NFPA standards as the basis for its protective suit procurement specifications. The existence of such standards by "themselves will also encourage improvements among manufacturers for better materials and end-products. This type of industry effort will therefore reduce the Coast Guard's need to undertake expensive development programs such as the one described in this final report.

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# APPENDIX A SELECTION OF PRIORITY CHEMICALS

(Condensed from Reference 7)

#### CLASSIFICATION OF CHEMICALS

#### Encapsulation Requirement:

- + Exposure to chemical requires encapsulating protection based on recommendations in "Material Development Study for a Hazardous Chemical Protective Clothing Outfit," Technical Report CG-D-58-80 (reference 2).
- Exposure to chemical does not require encapsulating protection, or no determination on the need for encapsulation has been made.

#### Spill History:

- + Chandral was involved in a spill as reported to the Pollution Information as reported in the U.S. Coast Guard Pollution Incident Reporting System, 1879-1983 (See Table 4-1).
- No spill history exists for the chemical during 1979-1983 in the Pollution Incident Reporting System.

#### Hazard Level:

A Chemical has been assigned either a carcinogen class "1" or highly toxic "2", or is toxic through skin absorption as reported in "A Marine Hazardous Substances Data System," Final Report CG-D-9-86 (reference 5); or the National Fire Protection Association has assigned the chemical a "4", its highest health hazard rating (reference 6).

- B Chemical has a hazard assessment index of "3" as reported in reference 5, or a NFPA rating of "3".
- C Other chemicals not included in either classes A or B.

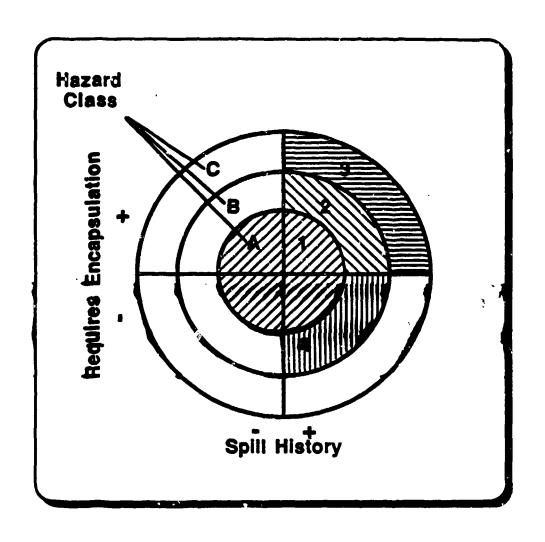


FIGURE 1. - SELECTION CRITERIA USED FOR PRIORITY HAZARDOUS CHEMICALS PERMEATION TESTING

# CHEMICAL PRIORITY CATEGORIES SELECTED FOR TESTING

Category I-IVA - All chemicals at Hazard Level A. Only 12 of these chemicals had not been designated as requiring encapsulation. A decision was made to include them in the testing group to avoid relying on a single source of personnel protection safety information (reference 2). This group included 51 chemicals.

Category IB - Hazard Level B chemicals with both an encapsulating suit requirement and a spill history. There were 24 chemicals in this group.

Category IC - Fourteen chemicals which had both a spill history and a need for encapsulating protection, but were not either of Hazard Level A or B.

Category IIIB - Chemicals in Hazard level B with a spill history but did not require ensapsulating protection. This group included 27 chemicals.

## TABLE A-1

# KEY TO DETECTOR CODES AND COLLECTION MEDIA FOR PERMEATING TESTING

Method of Detection	Collection Medium
Gas Chromatographic Techniques	
F = Flame Ionization Detector	air
Colorimetric Techniques	
E = Colorimetric Standard method or commercial test kit based on method	weter
Ion Chromatography	
A = Anion Column	
Other Techniques	
SI = Specific ion electrodes	water

TABLE A-2

# Group I-IVA Liquid Chemicals Arranged by Number of PIRS Spills ('73-'83)

PS = PIRS spills S = Need for encapsulated suit (Y=Yes)

CHRIS CHEMICAL NAME	DETECTOR CODE	PSS
BNZ benzene	F	91 Y
TOL toluene	Ė	81
ST' styrene	F	59
CRS cresol	F/C	33
PHN phenol	F/S	26
FMS formaldehyde	C	17 Y
MTC methyl chloride	H/E	15
ACN acrylonitrile	F	12 Y
NAC nitric acid	A/C	8 Y
VAM vinyl acetate	<b>F</b>	8 Y
VCI vinylidene chloride	N/E	<b>8</b> Y
ter carbon tetrachloride	M/E	5
HFA hydrofluoric acid	A/C	б 6 Y
TCL tricklerectylene	N/E	5 Y
ADM adiponitrile	₹.	5 Y 4 Y 3 Y 3 Y 2 Y
CRF chloroform	H/E	3 Y
EAM ethylamine	F	3 Y
ANL aniline	r	2 Y
BAN n-butyl alcohol	F	2 1 Y ,
BCL benzyl chloride	F	1 γ ້
BVA t-butyl amine	F	1 Y
CSA chlorosulfonic acid	A	1 Y
EPC epichlorohydrin	H/E	1 Y
HCN hydrogen cyanide	31/C	1 Y
MPT methyl parathion mp=65F	FP	1 Y
NTB nitrobenzene	Ε	1 Y
PTO parathion	FP	1 Y
POX propylene oxide	F	1
TEC 1,1,2,2-tetrachloroethar	ne H/E	0 Y
DPC 1,3-dichloropropene	H/E	0
DOX 1,4-dioxane	F	0
NPP 2-nitropropane	F/FP	0 Y
ALC allyl chloride	H/E	0 Y
BRX bromine	C/P	0 Y
CBB carbon disulfide(bisulfi	de) É	0 Y
CPL chloropicrin	H/E	ΟÝ
CTA crotonaldehyde	F	0 Y

TABLE A2 (continued)

CHRI	S CHEMICAL NAME	DETECTOR CODE	PS	<u>s</u>	
DEE	dichloroethylether	H/E	0	Y	
DIA	diisopropylamine	F	0		
	dimethyl sulfate	FP	0	Y	
	ethylene dibromide	H/E	0	Y	
	ethylene dichloride	H/E	Ŏ	Ý	
STA	glutaraldehyde	F	Ŏ	Ý	
HFX	hydrogen fluoride	C/A	Ŏ	Ý	
IPP	isopropylamine	F	Ŏ	Ÿ	
		compounds (lead alkyls) E	Ŏ	Ý	
TLI	o-toluidine	F	Ŏ	•	
	silicon tetrachloride	£	Ŏ	Y	
	toluene diisocyanate	Ē	Ŏ	Ý	
	acetone cyanohydrin	F	Ŏ	Ÿ	
BAM	n-butylamine	F	Ŏ	Ÿ	

There are a total of 51 chemicals.

There are a total of 398 spills.

TABLE A-3

# Group IB Encapsulated Suit Liquid Chemicals with a Spill History Arranged by Number of PIRS Spills ('73-'83)

PS = PIRS spills H = Hazard Index

N = MFPA classification

CHRIS CHEMICAL	NAME DETECTOR CODE	PS H N
SFA sulfuric acid	A/C	128 3 3
AAC acetic acid	F	13 3 2
ACT acetone	F	11 3 1
EAC ethyl acrylate	F	11 3 2
ACR acrylic acid	F	10 3 3
MIK methyl isobuty	1 ketone F	5 3 2
AAD acetaldehyde	F	4 3 2
TCE trichloroethan	e H∕E	4 3 2
ACE worth unhydric	de TŘ	232
ATN acetonitrile	F	232
ALA allyl alcohol	F	233
DPP dickloropropen	F/E	232
ACC acetyl chloride		1 3
ARL acrolein	F	1 3
MAM methyl acrylate	e F	1 3 2
TEL tetraethyl lea	d E	1 3
XYL xylenol	Ē	153
DNA di-n-propylami	ne F	053
<b>KDZ</b> hydrazine	P/C	0 3
PRA n-propyl amine		0 4 3
OLM oleum	A/C	0 3 3
PPT phosphorus tri		0 3
CSS sodium hydroxic		0 3 3
TML tetramethyl le		0 3

There were a total of 199 spills.

There are a total of 24 chemicals in this group.

TABLE A-4

# Group IC Encapsulated Suit Liquid Chemic&:s with a Spill History Arranged by Number of PIRS Spills ('73-'83)

PS = PIRS spills H = Hazard index N = MFPA index

 CHRI	S CHEMICAL NAME	DETECTOR CODE	PS H N
PCB	polychlorinated biphenyl compounds	Ε	92
CDN	chlordane	<b>E</b> .	3
HPO	hydrogen peroxide 60%	C	2 2
	· · · · · · · · · · · · · · · · · · ·	FP	2
BTR	n-butyraldehyde	F	252
SHR		C/A/Cat	2 5
ETO	ethion	FP	1
ETC	ethylene cyanshydrin	f	152
MLD	naled	E	3
	phosphorus oxychloride	C/A	1
SFM	sulfur monochlaride	EM	1 2
TEP	tetraethyl pyrophosphate	FP	1
CCT	creosote	F	052
CMH	cumene hydroperoxide	F	6 0
	- · · · · · · · · · · · · · · · · · · ·		

There were a total of 109 spills.

There are a total of 14 chemicals in this group.

TABLE A-5

# Group IIIB Non-encapsulated Suit Liquid Chemicals with a Spill History Arranged by PIRS Spiles ('73-'83)

PS = PIRS spills

H - Hazard assessment index

N = NFPA classification

CHRIS CHEMICAL NAME	DETECTOR CODE	PS H N
XLM xylene (meta-xylene as model)	F	92 3 2
EGL ethylene glycol	F	23 3 1
PAC phosphoric acid	C/A	22 3 2
CHX cyclohexane	F	17 3 1
MAL methyl alcohol	F	11 3 1
MTM naphchalene	F	10 3 2
EAL ethyl alcohol	F	930
MEK methyl ethyl ketone	F	631
EDA athylenediamine	N/E	5 3 3
TPT terpentine	F	5 3 1
DCM methylene chloride	H/E	4 3 2
HIA n-house	Ŧ	431
ETB ethyl benzene	Ŧ	3 3 2
1994 methyl methacrylate	F	3 3 2
DEA diethanolamine	F	2 3
CRB chlorobenzene	H/E	132
ETA ethyl acetate	F <sup>'</sup>	131
EET ethyl ether	F	132
FFA furfural	F	1 3 2
BCN n-butyl acetate	F	131
BTC n-butyl acrylate	F	1 3 2
PAL n-propyl alcohol	F	1 3 2
PNA propionic acid	F	132
GAT gasoline	F	031
IPA isopropyl alcolol	F	031
NSS naphtha	F	032
TTE tetrachloroethylene	H/E	0 3 2

There were a total of 224 spills.

There are a total of 27 chemicals in this group.

## TABLE A-S

## PRIORITY LIST HAZARDOUS CHEMICALS

## In order of Spill Frequency

CHRIS CHEMICAL NAME	PIRS SPILLS
SFA sulfuric acid	128
SHD caustic soda (sodium hydroxide)	95
PCB polychlorinated biphenyl compounds .	92
XLM xylene	92
BNZ benzene	91
AMA ammonia	85
TOL toluene	81
HCL hydrochloric acid	63
STY styrene	59
CLX chlorine	35
CRL cresol	33
PHN pheno?	26
EGL ethylene glycol	23
PAC phosphoric acid	22
FNS formeldehyde	17
CHX cyclohexane	17
MTC methyl chloride	15
AAC acetic acid	13
TTE tetrachloroethylene	12
ACH acrylonitrile	12
ACT acetone .	11
EAC ethyl acrylate	11
MAL methyl alcohol	11
ACR acrylic acid	10
NTM napthalene	10
EAL ethyl alcohol	9
NAC nitric acid	8
VAM vinyl acetate	8
VCI vinylidene chloride	8
ALM aluminum sulfite	7
CBT carbon tetrachloride	6
HFA hydrofluoric acid	6 6
MEK methyl ethyl ketone	0 E
TCL trichloroethylene	
EDA ethylenediamine	5 5 5 5
MIK methyl isobutyl ketone	ວ ຮ
TPT turpentine	4
AAD acetal dehyde	
DCH methylene chloride	4
HXA n-hexane	•

# TABLE A6(continued)

PIRS SPILLS
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#### APPENDIX B

## TEST METHODOLOGY FOR PERMEATION TESTING AND DETERMINATION OF MINIMUM DETECTION LIMIT

(Contractor Report by Texas Research Institute)



#### MONTHLY STATUS REPORT

## CHEMICAL TESTING OF PROTECTIVE CLOTHING MATERIAL

Contract No. NTCG39-86 A-80331 Task Order 9001

#### Submitted to:

Contracting Officer
U. S. Coast Guard Academy
New London, CT 06320-4195

#### Submitted by:

Texas Research Institute, Inc. 9063 Bee Caves Road Austin, TX 78733-6201 512-263-2101 512-263-3151



#### 1.0 INTRODUCTION

The majority of the time in the reporting period was devoted to setting-up for testing. This included modifications of the test apparatus to accommodate three permeation cells, and addition of valves and plumbing to permit the introduction of the permeant at a known concentration for the purpose of establishing minimum detectable limits. The apparatus and test results are described below.

#### 2.0 PERMEATION TEST APPARATUS

A photograph of the apparatus is attached as Figure 1, and a schematic of the valving and plumbing is shown in Figure 2. This configuration is different from the original design presented to Lt. Stull, the Project Officer, and Dr. Alan Betz, the COTR. The apparatus will simultaneously monitor the collection gas (N<sub>2</sub>) from three cells. Rather than switching from cell to cell, the system is currently monitored by routing the collection gas from the cells into a common line and then diverting a portion of this to the photoionization detector (FID). This type of composite testing was established to permit a more rapid tusting. No breakthrough will be observed with the majority of the chamicals shring the 3-hour maximum exposure period. Therefore, testing these chamicals with individual calls for 3 hours each would result in 9 hours of negative data. If breakthrough is observed, the cells will be we run individually and average breakthrough times and permeation races will be calculated.

The testing is conducted in the following manner. Instrument-grade nitrogen is introduced into the system through three flow meters, each controlling the flow to the collection side of the permeation cells (refer to the yellow lines in Figure 2). Flow rates are set at 90 ml/min., which is equivalent to two volume changes per min. in the collection side. Preliminary experiments have shown that with toluene as a permeant and plasticized polyolefin as the barrier, flow rates did not affect breakthrough times except below 30 ml/min. It was reasoned that flow rates above 90 ml/min. would only decrease the sensitivity of the system. More importantly, an increase in flow rate would result in a substantial increase in pressure. This pressure against the sample would more than likely alter the permeation rate. All of the tubing and fittings throughout the system are narrowbore glass, Teflon, and stainlass steel and are not conducive to high (> 100 ml/min.) flow rates without rises in pressure. It might by argued that this flow rate is insufficient to result in vaporization of rapidly permeating and poorly volatile chemicals. If this case were to happen, TRI feels that results from every test system could be questioned. Breakthrough times are not expected to vary appreciably. However, permea-tion rates would reflect both diffusion plus the volatilization rate of the chemical. Thus, the flow rate and resulting volatilization rate in one system would give different results from another system even though the recommended minimal flow rates, as specified by the ASTM Standard, were met.



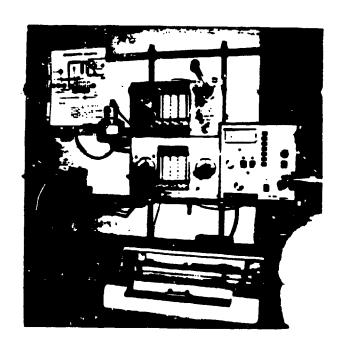
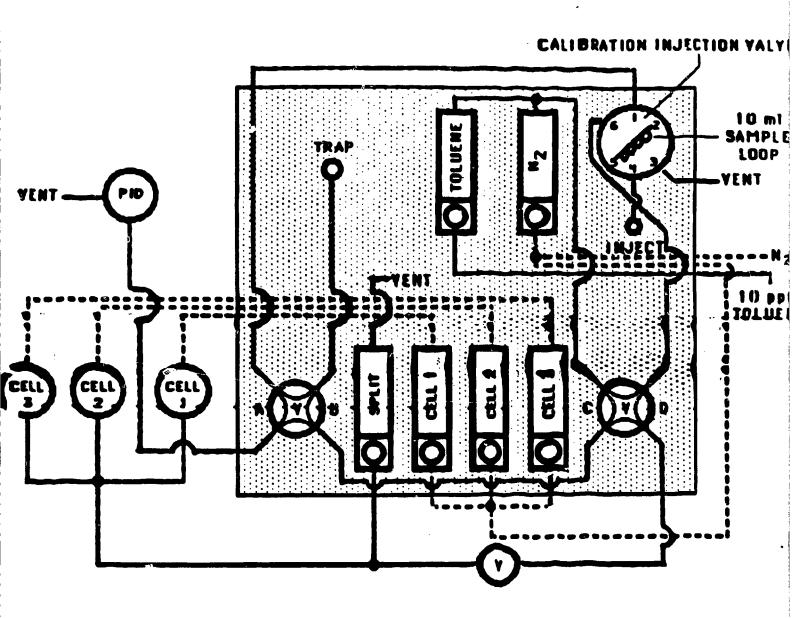


Figure 1 - Photograph of PID System

### Permeation test apparatus



# A C CELLS TO DETECTOR VIA INJECTION VALVE. N<sub>2</sub>/TOLUENE TO TRAP. CELLS TO TRAP. N<sub>2</sub>/TOLUENE TO DETECTOR VIA INJECTION VALVE. CELLS TO TRAP VIA INJECTION VALVE. N<sub>2</sub>/TOLUENE TO DETECTOR.

POSITION

B

**PROCESS** 

CELLS TO DETECTOR.

N2/TOLUENE TO TRAP VIA INJECTION VALVE.



The carrier gas exiting the cells is split, so that 60 ml/min. is routed to the PID and the remainder is vented (refer to blue lines in Figure 2). The portion going to the detector flows first through a Swagelok needle valve to control the split and then that to a two-position valve with positions marked "C" and "D". From this valve the gas can either flow directly to a second valve with positions "A" and "B" or arrive at that valve via a calibration injection valve. The gas can then be routed to the PID or to the port for trapping with adsorbents.

A typical test might proceed as follows. A cell is prepared and attached to the system without the challenge chemical. The glassware and Teflon gaskets are baked in a vacuum oven at 100°C to prevent out-gasing of contaminants. The flow rate and electrometer/detector settings are established to record a steady baseline. This timing of the test begins upon addition of the challenge chemical. The recorder indicates the breakthrough time and the lag period before steady-state permeation is reached. When steady-state permeation is indicated, the valve is switched to position "B" thus diverting the gases to the adsorbent trap (e.g., charcoal, Tenax, through state gall. Several adsorbent tubes are used to callect discrete sample volumes. These tubes are desorbed and analyzed by gas chromatographic techniques specified by the NIOSH Manuals. If no breakthrough occurs during the 3 hour maximum test period, two mathods for checking the sensitivity and minimum detectable limits for the system are amployed.

The first method involves the establishment of a known concentration of toluene in the system. Figure 2 depicts the process of calibration wit: toluene. A 10.2 ppm toluene in nitrogen mixed gas (Scott Specialty) is routed through a flow meter (marked toluene) and joins downstream to a nitrogen line. The two flow meters (toluene and nitrogen) allow the mixing of a standard gas containing from zero to 10.2 ppm toluene. The mixed gas is then routed through the system to the PID. Figure 3 shows a typical detector response in millivolts as a function of toluene concentration from one to five parts per million. The scatter in data points is not due to the detector response, but rather to the inability to accurately produce a toluene standard using the flow meters. However, for these purposes the accuracy of the toluene standards is acceptable. The sensitivity of the system exceeds the limits of the flow meters to mix a very low (< 1 ppm) toluene standard. The noise in the system is  $\pm$  0.4 mv. A signal that is twice the noise would be easily recognized. Based on this assumption, a signal of 0.8 my above baseline would be the minimum detectable limit. For toluene, the 0.8 my response would correspond to 0.04 ppm toluene at a 60 ml/min. flow rate through the detector.

Other chemicals with a substantially different response will have different minimum detectable limits with the PID system. Therefore, if no breakthrough occurs, MDLs will be checked in an empirical manner by a second mathod. This involves a 6-port injection valve and calibration sample loop that is illustrated in Figure 2. A static gas sample is prepared with glass, gas

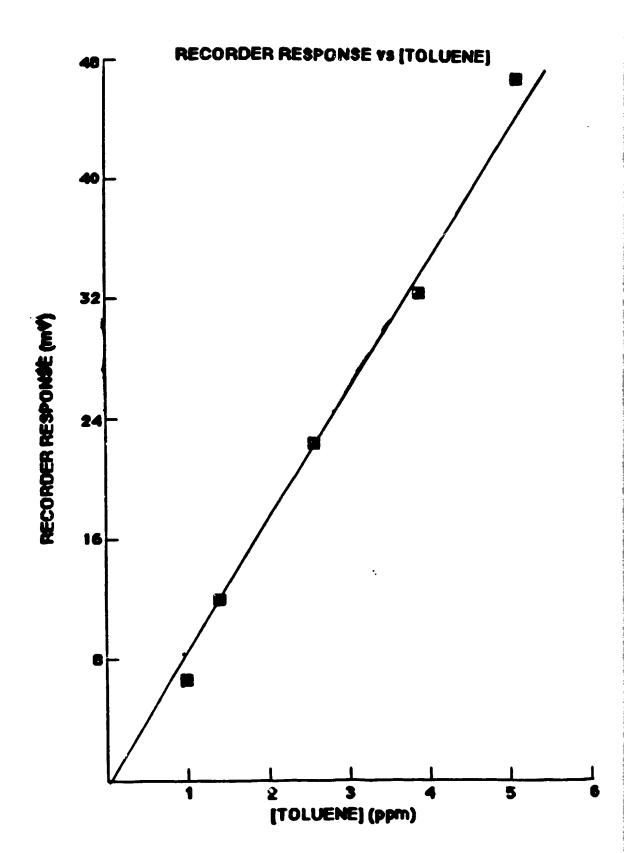


Figure 3 - Sensitivity and Linearity of PID to Toluene.



collection bottles equipped with septa. Typically, the standard is prepared by volatilization of a known amount of the chemical followed by appropriate dilution. The prepared standard ( $\leq 1$  ppm) is then loaded in the injection sample loop (10 ml) and injected in the system at 60 ml/min. The detector will respond for approximately seven seconds to this chemical. Assuming linearity in the detector response, an MDL will be calculated at a signal that is twice the noise. This value will always be overstat ', simply because the standard chemical that is injected will be less than the calculated concentration due to unavoidable sorption of the chemical to glass and metal surfaces.

#### 2.1 Problem Areas

The permeation testing of the Challenge 5100 material has been slow to get started. There are several reasons for this. One is the re-fixturing to accommodate three cells and to provide for a method of establishing NDLs for each chemical. The following is a list of gliches and set-backs that have been corrected:

- (1) Off-gassing of hydrocarbons from 0-rings and adsorption of permeants by 0-rings. Corrected by going to all stainless steel and glass construction with short segments of Tellen tubing.
- (2) Looks in cells because of back-pressure from low dead volume tubing and improper tightoning of flanges. Corrected by replumbing the system to eliminate back pressure. Verification of leak-proof assembly was achieved by testing of cells with a device containing a magnahelic gauge. Small leaks can be quickly detected during assembly of the cells.
- . (3) Sensitivity of the system to vibrations and temperature changes. Corrected, as best as possible, by placement in a stable environment.
  - (4) Problems with off-gasing of previously used Teflon gaskets and glassware. Corrected by incubation of the gaskets in a vacuum oven at 100 C.
  - (5) System shut-down due to damaged UV light source. Corrected by replacement of the light source. The light source was of a new design, thus necessitating a restart of permeation testing because of different sensitivity.
  - (6) Adsorption of chomicals on the walls of the stainless steel tubing. It is apparent that some adsorption of chemicals will unavoidably occur on the walls of the tubing. This has been observed with system checks using toluene. TRI is still in the process of grappling with this problem which is common to all sensitive permeation test apparatuses. The only area that is affected is the minimum detectable limits because the path of the



MDL standards is not exactly the same as the permeants. If no solutions can be found, MDL values will be expressed as "less than or equal" values. that is, if 0.1 ppm of a standard gave a detector signal of twice the noise, then the MDL would be reported as ≤ 0.1 ppm. The less than figure would signify that the concentration at the detector was prebably less than 0.1 ppm because of adsorption, but if there were 0.1 ppm at the detector, the detector response would have been at least twice the noise.

#### 3.0 RESULTS

Complete tests of the material with toluene, styrene and cresol have been completed. These are attached in the requisite formatting and with Xerox copies of actual recorder tracings. Phenol has been tested with no breakthrough. However, these results are pending the establishment of MDLs.

#### 4.0 PROJECTED SCHEDULE

The apparatus is currently working well except for the previously stated problem with establishing MDLs. Rather than delay testing, TRI will continue to do the tasting and establish MDLs at a later date, when other ideas have tested. TRI will continue to use the toluene standard to verify reproducibility and sensitivity of the system.

The projected schedule is 10 chemicals per week. This schedule was started April 3 and barring unforeseen problems, the 117 chemicals will easily be completed before the end of the fiscal year.

It is suggested that the COTR visit TRI for discussions on MDLs, future work with mixtures, and analytical methods that do not use gas chromatography. It is also suggested that test sheets of well-characterized neoprene be provided to TRI for testing with one or more chemicals. This testing will ensure that test results with the PID system are comparable to those reported by other investigators.

# CHEMICAL PROTECTIVE CLOTHING PRODUCT EVALUATION DATA (One Material-One Chemical Series)

. DES	SCRIPTION OF PRODUCT EVALUATED		
A:	TYPE: Teflon leminated NOMEX		
B:		nge 5100	
C:		. no visible imperi	ections
D:		D.	
E:	CATALOG NUMBER: N/A		
P:	LOT OR MANUFACTURER DATE: N/A		
G:	NOMINAL THICKNESS: 15-20mil		
H:	DESCRIPTION:		
I. TES	ST METHOD (ASTM F739-81 or EQUIV	ALENT)	
٨.	DATE TESTED: April 2, 1986		
R.	TESTING LABORATORY: Texas Rese	arch Institute	
	The Day D	eves head, Austin,	72 74733
C.	ANALYTICAL NETROD: Continuous	photoionization de	tection
	TEMPERATURE: 22-25		
Z.		•	
	SYSTEM: No		
T.	OTHER TEST CONDITIONS:		
	DEVIATIONS FROM ASTM P739-81 M	ETHOD: Flow rate t	o cells was 90cc/min
	COMMENTS:		
<b>A.</b>	CHEM NAME(s) : Toluene	: Toluene	: Toluene
В.	CAS NUMBER(s): 292	: 292	: 292
c.	CONC. (IF MIX): N/A	: N/A	: N/A : J.T. Baker
D.	CHEMICAL SOURCY: J.T. Baker	: J.T. Baker	: J.T. Baker
	Reagent grade	: Reagent grade	
IV. TE	EST RESULTS		
	NUMBER OF SAMPLES TESTED: Three		
B.	BREAKTHROUGH TIME: No breakthr	ough was observed a	after 3 hours.
	MIN DETECTABLE LIMIT: 0.04 ppm		
C.	STEADY STATE PERMEABILITY RATE:		
	ANALYTICAL SENSITIVITY: 0.3 Co		ne)
D.	SAMPLE THICKNESS: 17-19 mil		
E.	OTHER OBSERVATIONS:		
v. sc	PURCE OF DATA Samples were run by Karen Vers	choor on April 2.	1986

nquidT mag F Chemical Resistance Testing of USCG Material with Toluene le: docc/min Flow rateita



#### FINAL TASK REPORT

## SYRINGE PUMP NETHOD FOR DETERMINING MINIMUM DETECTION LINIT

Chemical Resistance Testing of Protective Clothing Material

Contract No. DTCG39-85-A-80331
Task Order 003

#### Submitted To:

Contracting Officer U.S. Coast Guard Academy New London, CT 06320-4195

#### Submitted By:

Texas Research Institute, Inc. 9063 Bee Caves Road Austin, TX 78733-6201 512/263-2101





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#### 1.0 INTRODUCTION

The determination of minimum detection limits is necessary to obtain meaningful permeation results for the USCG project. A syringe pump method has been used with satisfactory results with TRI's permeation test system. This final report outlines the further development of this methodology. Completion of this third task order also includes an application manual and fabrication of the system.

#### 2.0 EQUIPMENT

The apparatus used to perform the permeation testing consisted of ASTM standard two inch or one inch glass permeation cells with PTFE gaskets and a photoionization detector. Stainless steel tubing and short pieces of flexible PTFE tubing allowed a flow of nitrogen to continually sweep through the collection side of the cell to the detector. The photoionization detector was an HNU model PI-52-02 outfitted will either an 11.7 or 10.2eV lamp. The response from the detector was recorded on a Houston Instruments strip chart recorder.

A Sage Instruments syringe pump Model 341 was used with an SGE, gas tight, removable-needle, 5 µl glass syringe to pump the chemical of interest. The syringe was outfitted with needles cut from small diameter vitreous silica tubing. The syringe was modified to better fit the needs of the system.





#### 3.0 METHODS

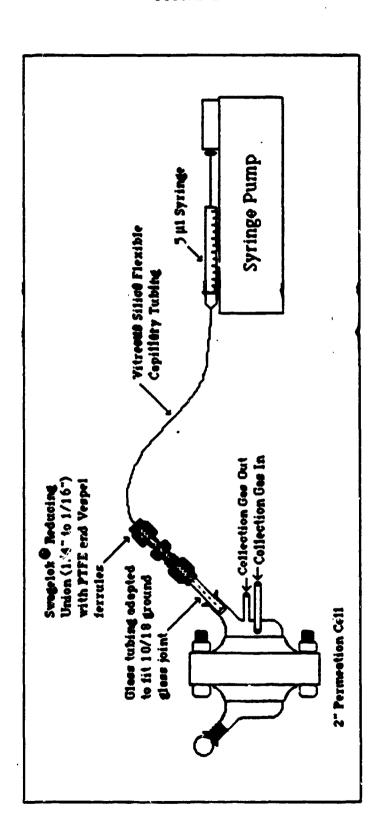
The permeation test apparatus was operated by methods consistent with ASTM method D-739. Standard 2 inch permeation cells were used in which aluminum foil was sandwiched between the challenge side and the collection side of the cell to create an impermeable varrier for MDL determination. Nitrogen flowed at 100 cc/min into the collection side of the cell, across the sample surface and out to the photoionization detector in an open loop system. The collection side of the cell was continually monitored for the presence of the challenge chemical.

Minimum detection limits were determined by pumping the chemical of interest into the collection side of a standard permeation cell at a very slow rate using a syringe pump. The chemical was filtered prior to filling the syringe using a 0.2 micron disposable filter assembly. The tip of the needle was placed into a specifically fabricated glass joint fitted to the permeation cell (see Figure 1).

A constant low level concentration of the chemical of interest was delivered to the detector via the same pathway a permeant would travel. The pump rate could be adjusted from a minimum of 0.116 µl/hr to many higher settings. The concentration of the chemical of interest being delivered to the detector was calculated using the following equation:



FIGURE 1





where d is the density, MV is the molar volume (24,450 ( $\mu$ l/mmole)), PR is the syringe pump rate ( $\mu$ l/hr), MW is the molecular weight (mg/mmole), and F is the nitrogen flow rate (l/hr).

The millivolt response generated from the determined concentration was used to calculate the minimum detectable limit. The minimum detectable limit was subjectively defined as the concentration corresponding to the response that was twice the moise level. The noise level was determined as the long term fluctuation from the average baseline.

#### 4.0 APPLICATIONS

Initially the response generated by the slow introduction of the chemical into the permeation cell was not a smooth recorder tracing. The tip of the needle was placed directly in the stream of nitrogen entering the collection side of the permeation cell. This resulted in a wildly pulsating response that centered around the expected value. This was possibly caused by microdroplet formation at the tip of the needle. An increased response was produced when the droplets were dispersed by the force of the nitrogen stream and evaporated. This was followed by a period of lower response while the microdroplet was reforming.





To alleviate this problem, the needle was then placed into the adapter at the glass joint of the permeation cell. This removed the tip of the needle from the turbulent nitrogen stream and forced the chemical to diffuse down the glass adapter before entering the outlet stream. This diffusion process helped to average out minor concentration variations. It was found that the placement of the needle closer to the nitrogen stream caused a more varied response. Placement of the needle tip in the center of the length of the ground glass stopper provided the optimum response.

Three sizes of capillary tubing (0.025, 0.050, and 0.075 mm inside diameter) were used as needles in the system. It was expected that a smaller diameter tubing would decrease the size of the microdroplet formed and help decrease the amplitude of the pulsing response. The tubing had no apparent effect on the response.

A disk of glass fiber filter was cut to fit the inside diameter of the ground glass adapter and placed at the tip of the needle. It was expected that the filter would act as a microporous diffuser and reduce the pulsing effect of the microdroplet formation. In actuality the filter was found to act as an absorbent, retaining the chemical of interest and holding it for a period of time that decreased the efficiency of the MDL determination. It was also difficult to keep the filter in place at the tip of the needle.



Temperature had a strong effect on the response generated. Minor increases in temperature such as those produced by touching the needle created a spiked response. The signal would then fall below the expected value before resuming the initial response. This effect could be explained by thermal expansion of the liquid within the barrel of the syringe and the needle itself. Efforts were made to insulate the needle, although this had little effect on improving the pulsing of the response.

The cells and syringe pump were placed in an incubator in an effort to thermostat the system. This effectively smoothed the signal. Some pulsing was observed that could be attributed to the turning on and off of the heating element to produce slight fluctuations in temperature. The liquid in the needle and the barrel of the syringe emulated a very sensitive thermometer. The expansion and contraction due to temperature changes altered the rate of delivery. Because of this "thermometer effect" it was critical that the temperature be precisely and smoothly maintained.

The concentration delivered to the detector is strongly dependent on the flow rate of nitrogen to the detector and the flow rate of the chemical of interest into the cell. Any leaks in the system or variances in the flow rate had a substantial effect on the response.





The syringe itself was evaluated and modified to better fit the needs of the system. A metal stop was added near the end of the barrel to keep the barrel from slipping in the pump's syringe holder. The syringe guide tip was glued to the base of the syringe to eliminate one source of leaks. It was found that the PTFE tip on the plunger must fit tightly in the barrel of the syringe to insure that the correct amount of chemical is delivered into the permeation cell. It was believed that at slow pump rates a portion of the liquid escapes around the tip of the plunger resulting in a lesser amount of chemical being delivered to the cell.

Detector response for toluene was investigated as a function of standard 1" and 2" permeation cells. There was no discernible difference in the response values.

#### 5.0 VALIDATION

Known concentrations of standard toluene gas were introduced into the system and compared with the detector response from toluene introduced via the syringe pump (Figure 2). As expected, the responses generated from the standard toluene gas were linear with respect to concentration (square symbols in Figure 2). Neat toluene delivered into the system by the syringe pump is shown with the triangular symbols in Figure 2. The lowest concentration, 4.45 ppm, was calculated from the slowest pump rate (0.116 µl/hr) at a flow rate of 100 ml/min. Lower levels of toluene (circular symbols) were achieved by diluting the toluene in acetonitrile, which is not seen by



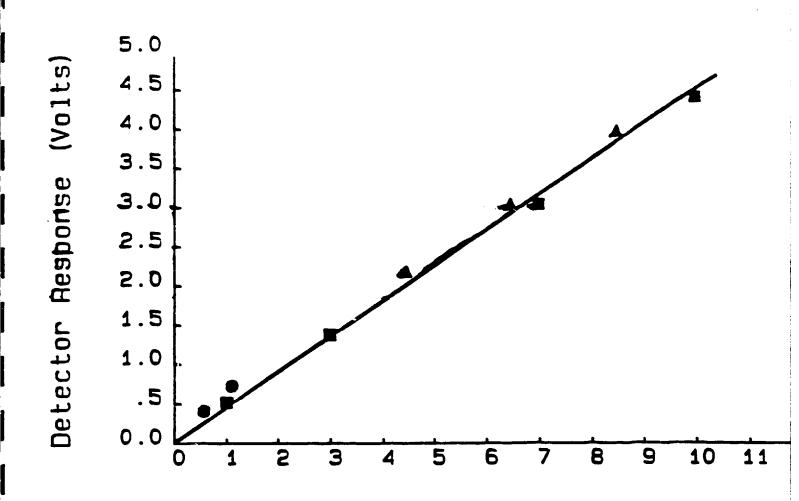


Figure 2. Comparison of the Responses of Toluene Introduced via the Syringe Pump with Known Concentrations of Toluene Gas.

Toluene (ppm)

Standard toluene gas concentrations (2);
Calculated toluene levels from neat
Toluene introduced with the syringe pump (4);
Calculated toluene levels from toluene
diluted in acetonitrile and introduced
with the syringe pump (6).



the photoionization detector. Figure 2 illustrates that the calculated concentrations of toluene delivered by the syrings pump are the same as known levels of standard toluene gas and that the syringe pump method can reproducibly introduce toluene vapors into the permeation test system in a linear fashion.

The dilution of toluene in acetonitrile is an example of an effective method to achieve low concentrations for NDL determinations. The chemical of interest is diluted in a volatile solvent that is not detected by the method of analysis. For example, for systems using electron capture detectors, 2,2,4-trimethylpentane or other appropriate alkanes enald be smelal as a dilution solvent. In addition to dilution, solvents provide an effective method for introducing less volatile and viscous compounds into the system for MDL determination. The highly volatile solvents would act in vaporizing the chemicals that would tend to remain at the tip of the needle in the neat, liquid state.

Five other chemicals (acetone, benzene, hexane, tetrachloroethylene, and styrene) with varying volatilities were also tested in the syringe pump system for linearity of response. The results of these tests are outlined in Figures 3-7. The linearity of the responses indicates that the syringe pump method is applicable to MDL determinations for other organics.



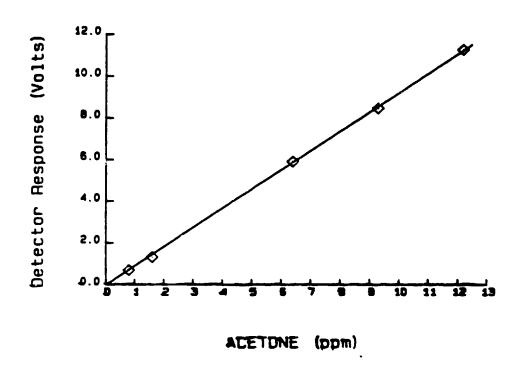


Figure 3 - Linearity of response with respect to concentration of Acetone delivered by the syringe pump system.

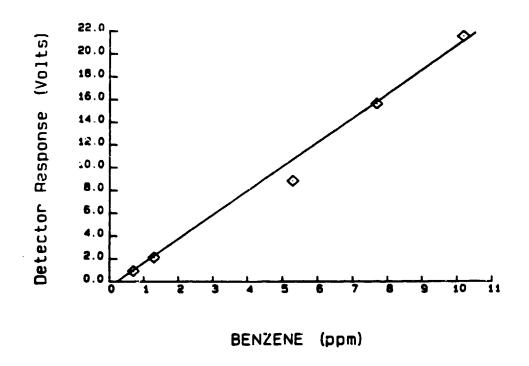


Figure 4 - Linearity of response with respect to concentration of Benzene Celivered by the syringe pump system.



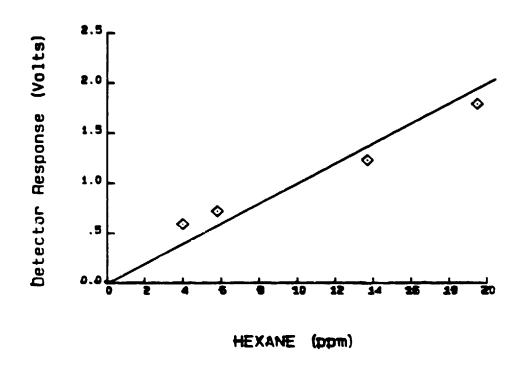


Figure 5 - Linearity of response with respect to concentration of Hexane delivered by the syringe pump system.

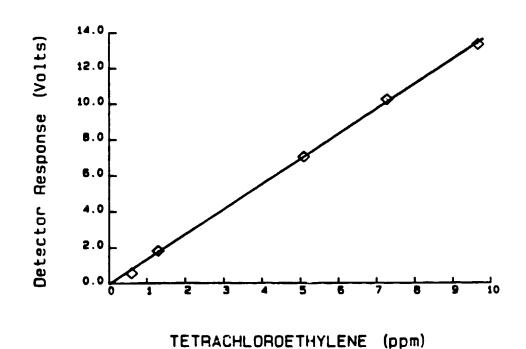


Figure 6 - Linearity of response with respect to concentration of Tetrachloroethylene delivered by the syringe pump system.



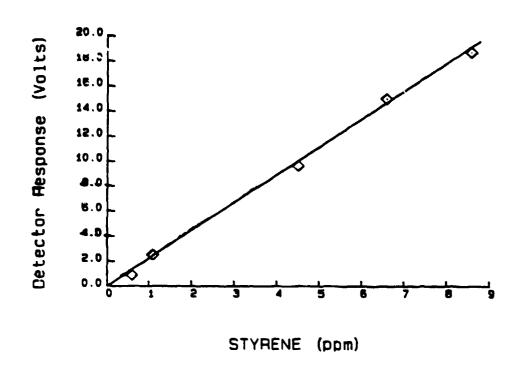


Figure 7 - Linearity of response with respect to concentration of Styrene delivered by the syringe pump system.



#### 6.0 CONCLUSION

Reported breakthrough times in permeation testing are stroolly dependent upon the sensitivity of the analytical method used. The standard method, ASTM D-739 gives guidelines for performing permeation testing but does not specify the analytical methods or the complete test apparatus. A universal technique for comparing and correlating results from different systems is needed. The syringe pump method is an effective technique which delivers known concentrations through the same pathway that the permeant would travel. It allows detection limits and permeation testing to be performed at different times and correlated by the relationship of a standard gas (toluene), thus compensating for differences in sensitivity. Differences in the size of tubing, size of permeation cell, and position of the needle tip have little effect on the efficiency of the system. Modification of the syringe, attention to flow rates, and maintenance of a constant temperature are important items to consider when optimizing the syringe pump method for determining NDLs.



#### APPLICATIONS MANUAL

SYRINGE PUMP METHOD FOR DETERMINING MINIMUM DETECTION LIMIT

Chemical Resistance Testing of Protective Clothing Material

Contract No. DTCG39-86-A-80331 Task Order 803

Submitted To:

Contracting Officer U.S. Coast Guard Academy New London, CT 06320-4195

Submitted By:

Texas Research Institute, Inc. 9063 Bee Caves Road Austin, TX 78733-6201 512/263-2101





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#### 1.0 INTRODUCTION

An innovative method for determining minimum detection limits in permeation testing has been developed. A syringe pump is used to deliver the chemical of interest into a standard ASTM permeation cell at a very slow rate. A constant low level concentration of the chemical of interest is sent to the detector via the same pathway the permeant would travel. The purpose of this manual is to instruct the reader in the application of this system.

#### 2.0 INSTRUMENTATION

Sage Instruments Model 341 syringe pump

SGE gas tight, removable needle, 5ul glass syringe

SGE vitreous silica tubing, 0.075mm

Glass adapter and fittings

Standard ASTM permeation cell, 1 or 2 inch

#### 3.0 CALIBRATION

Calibration of the syringe pump is necessary to determine the rate of delivery of the chemical of interest.

A. Plug in the syringe pump and note that the power light is on when the toggle switch is set to either pump rate (ml/min or ml/hr).



- B. Place the drive carriage (black box) on the gears at the far right position, making sure the box is parallel to the edge of the pump.
- C. Mark the position of the drive carriage (a piece of masking tape works well for this).
- D. Set the rate selector switch to 1. Turn he mode switch to the "on ml/hr" position.
- E. Make note of the time. Allow the pump to operate at least 24 hours.
- F. Turn off the pump and again note the time. Measure the distance the drive carriage has traveled in centimeters.
- G. Calculate the delivery rate using the following equation:

Distance traveled in cm x 5ul 2.55cm

Where 2.55cm corresponds to the length of 5µl of liquid in the SGE syringe.



For example, if the drive carriage traveled 3.5cm in 60 hours the calculation would be:

$$\frac{3.5 \text{cm}}{60 \text{ hrs}} \times \frac{5 \text{µl}}{2.55 \text{cm}} = 0.114 \text{µl/hr}$$

This is the amount of chemical delivered per hour at a pump rate setting of 1ml/hr with the SGE 5µl syringe.

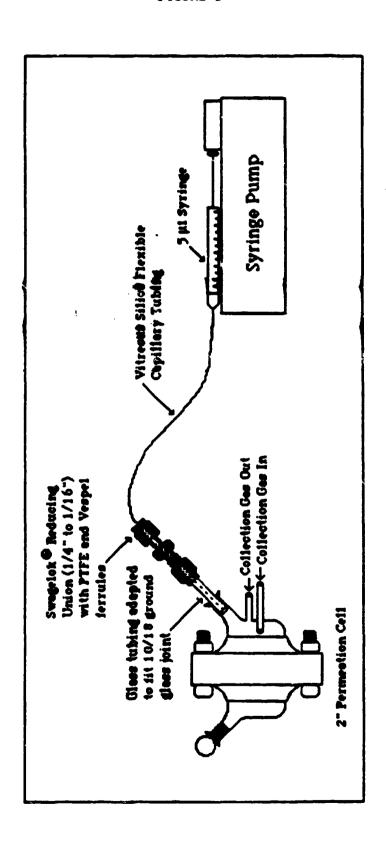
4.0 METHOD

- A. Standard 1 or 2 inch permeation cells may be used with this method.
  - 1. To use a standard 2 inch permeation cell, sandwich aluminum foil between the challenge and the collection side of the cell. (This creates an impermeable barrier, keeping the chemical of interest on the collection side of the cell.)

    Position the cell so that the collection side of the cell is facing the syringe pump (See Figure 1). Place the ground glass stopper in place in the cell.
  - 2. To use a standard 1 inch permeation cell, seal the challenge and the collection sides of the cell together. Position the cell so that the challenge side is facing the syringe pump. Place the ground glass stopper in place in the cell.



#### FIGURE 1





- B. Set the detection system for standard conditions as per normal operating procedure. Set the appropriate nitrogen flow through the permeation cell and to the detection system. Adjust the baseline to zero. Allow the system to stabilize while proceeding with steps C-J.
- C. Cut a piece of vitreous silica tubing to a length convenient to reach from the syringe to the inside of the permeation cell. Remove the end cap from the syringe and thread the tubing through the cap and through the teflon spacer so that the tubing extends approximately one inch past the end of the syringe side of the cap. (Note if the tubing will not fit through the teflon spacer, the hole in the spacer can be enlarged with the reaming tool provided with the syringe.)
- D. The syringe can be filled with the chemical of interest by one of two methods:
  - The syringe can be back-filled by using another syringe to fill the barrel. A 5-10µl syringe with a small diameter needle slightly longer than the length of the SGE syringe works well for this. Fill the back-fill syringe with the chemical of interest; insert the needle in the SGE syringe and fill the barrel, making sure there are no bubbles in the liquid.



- 2. The syringe can be filled by directly placing the tip of the syringe (without the tubing or the end cap on) in the chemical of interest and siphoning the chemical into the syringe. A 10 ml size pipette pump works well for this. Attach the pipette pump to the end of the syringe, place the syringe in the chemical of interest and slowly suck the chemical into the syringe. When the chemical is above the plunger line, carefully detach the pipette pump. The pipette pump can also be used to eliminate bubbles in the barrel by pulling a gentle vacuum on the chemical and forcing the bubbles to rise to the surface.
- E. Attach the end cap with the vitreous silica tubing to the filled syringe. Make sure that the syringe end of the tubing is "square" and butts up tightly against the metal guide tip. Finger tighten the end cap as tight as possible. Gently tug on the silica tubing to make sure the tubing fits tightly.
- F. Carefully place the teflon tipped plunger in the syringe, making sure that no air bubbles are trapped at the tip. The plunger should fit snugly in the barrel, but one should not have to force it. A slight bend to the metal portion of the plunger when pressure is applied is permissible.
- G. Apply pressure to the plunger until the chemical comes out of the tubing.



- H. Lift the knob of the spring loaded syringe holder high enough to accommodate the syringe barrel. Place the loaded syringe in the syringe holder, resting the metal stop on the back of the holder. Lower the knob to hold the syringe in place.
- I. Place the drive carriage on the gears, making sure the carriage is parallel to the edge of the pump. Advance the drive carriage by turning the rate selector switch to 9 ml/min. As the carriage approaches the syringe, check to make sure that the pump actually delivers the chemical from the tip of the needle. As soon as the chemical can be observed coming from the tip of the needle, turn the pump off.
- J. Thread the vitreous silica tubing through the fittings in the specially fitted glass adapter. Position the tip of the tubing in the center of the ground glass stopper. Tighten the fitting at the other end of the adapter to hold the tubing in place.
- K. Remove the stopper from the equilibrated permeation cell system and replace with the adapter. To insure a tight seal, a small amount of stopcock grease may be placed on the stopper. Hold the stopper in place by sealing with a small piece of parafilm.



L. Set the rate selector to 1 and switch the mode to ml/hr to begin pumping the chemical into the system. A response should be detected within a few minutes, depending on the volatility of the chemical of interest. Allow the response to reach a steady state before concluding the analysis. Remove the adapter and replace with the ground glass stopper to check the baseline at the completion of the run.

#### 5.0 CALCULATIONS

The concentration of the chemical of interest delivered to the detector is determined by the following formula:

PPM delivered = <u>d x MV x PR</u>

MW x F

Where d is the density of the chemical of interest

MV is the molar volume (24,450 µl/mmole)

PR is the syringe pump rate (µl/hr)

MW is the molecular weight of the chemical of interest (mg/mmole)

F is the nitrogen flow rate (l/hr)



The minimum detection limit was subjectively defined as the concentration corresponding to the response that was twice the noise level. The noise was determined as the long term fluctuation from the average baseline. The MDL is calculated by the following formula:

MDL in ppm = ppm delivered x 2 x N R

Where N is the noise in millivolts

R is the response of the chemical of interest in millivolts

NOTE: This equation can also be used with detection systems that respond in units other than millivolts. The use of different units will have no effect on the determination as long as the noise and the response are measured in the same units.

For example, the MDL for toluene would be determined as follows:

ppm delivered = 
$$0.8669 \times 24450 \times 0.114 = 4.37 \text{ ppm}$$
  
92.15 x 6

If the millivolt response generated by toluene was 2160, and the noise was 32, the NDL would be determined as follows:

MDL in ppm =  $\frac{4.37 \times 2 \times 32}{2160}$  = 0.129 ppm



#### 6.0 TROUBLESHOOTING

#### A. No Response, lower than expected response

- 1. Check all fittings for leaks
- 2. Check the syringe for clogs and/or bubbles
- Make sure pump is actually delivering the liquid
- 4. Check syringe for leaks
  - a. Break off the tip of the silica tubing that fits into the guide tip of the syringe and resecure the cap.
  - b. Check tip of plunger, resize if necessary. The teflon tip can be resized by heating it to 350 degrees, causing the teflon to expand. (If the plunger does not fit tight enough, liquid will escape around the tip of the plunger.)
  - c. Replace the teflon spacer inside the end cap of the syringe.

#### B. Excessive noise, Pulsing of response

- 1. Check all fittings for leaks
- Check placement of needle in adapter (Generally, the closer the tubing is to the nitrogen flow, the greater the pulsing response).
- 3. Check syringe for clogs. Clean with cleaning wire.



#### 7.0 NOTES

- A. The importance of tightly fitting tubing and ferrules cannot be over emphasized.
- B. The syringe should be treated with great care at all times, as it is very easy to apply too much pressure to the plunger and split the barrel. Do not force the plunger. If the plunger requires force to inject the chemical check the barrel and guide tip for closs and clean with a cleaning wire before proceeding.
- C. The syringe should be cleaned with acetone and dried between uses.
  It should be flushed several times with the chemical of interest when loading.
- D. Various sized vitreous silica tubing can be used. Tubing with inside diameters of .025 and .050 mm have also been used with success. The 0.075 mm sized tubing does provide the tightest fit and most durability.
- E. Filtering the chemical of interest to remove particulates is not usually necessary when using a good quality reagent.



- f. To achieve very low concentrations of the chemical of interest, dilute with a volatile solvent that is not detected by the method of analysis. For example, for systems using electron capture detectors, 2.2.4-trimethylpentane or other appropriate alkanes would be useful as a dilution solvent. This technique is also useful for introducing less volatile and highly viscous compounds into the system. The highly volatile solvents act in vaporizing the chemicals that tend to remain at the tip of the needle in the neat, liquid state.
- 6. Known concentrations of a standard toluene gas were introduced into the system to provide a means for comparing NDLs run at different times. With this method, it is only necessary to make one NDL estimation. By using the ratio between the responses of the standard gas at the time of the MDL determination and at the time of the actual permeation testing, the response value of the chemical of interest can be adjusted for any differences in the sensitivity of the instrument. This not only provides a means for correlation of results, it acts as a check on the reliability of the system.

#### APPENDIX C

#### PERMEATION TEST DATA FOR PRIORITY LIQUID CHEMICALS

(Contractor Report by Texas Research Insitute)



86176:KLV 17. October 1986

#### MONTHLY STATUS REPORT

CHEMICAL RESISTANCE TESTING DF PROTECTIVE CLOTHING NATERIAL

Contract No. DTCTG39-B6-A-B0331 Task 0001

Submitted to:

Contracting Officer
U.S. Coast Guard Academy
New London, CT 06320-4195

Submitted by:

Texas Research Institute, Inc. 9063 Bee Caves Road Austin, TX 78733-6201 512-263-2101 512-263-3151



#### 86176:KLV

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#### 1.0 INTRODUCTION

this report outlines the methods and results of the work done on the permeation testing of flat samples of Challenge 5100 for the U.S. Coast Guard. The first task of permeation testing with the 115 CHRIS chemicals was completed October 15, 1986.

#### 2.0 METHODS

The majority of the chemicals were tested using a continuous photoionization detection technique. The standard permeation cells and Teflon gaskets were baked in a vacuum oven at 100C prior to each run to prevent off-gassing of contaminants. Instrument-grade nitrogen was used to sweep the collection side of each cell at a rate of 100 cc/min. A portion of the composite flow from three cells was routed to an HNU photoionization detector model PI-52-02 putfitted with either a 10.2 pr 11.7 eV lamp. After a steady baseline was recorded, the challenge chemical was added and the timing of the test began. Three cells were monitored concurrently for three hours or until permeation reached steady state. If breakthrough did occur, one individual cell was rerun.

After each run a response reading was taken for a 1.0 ppm standard toluene mixture. This enabled the monitoring of the sensitivity of the detector daily and allowed repeat runs to be performed under the same conditions by altering the lamp intensity.

Minimum detection limits (MDL's) were determined using a syringe pump. The syringe pump was used to deliver the chemical of interest directly into the permeation cell at a rate of .1257 ul/hour. This slow rate of introduction into the stream of N2 . delivered a steady low level concentration of the chemical to the detector. This concentration was calculated as follows:

ppm = u1/ 1 N2

= density(mq/ml) x 24,450 (ul/mmole) x .1257 (ul/hour)
molecular weight (mg/mmole) x N2 rate (l/hour)

The response generated by this calculated concentration was then used to determine the MDL. The MDL was defined as the concentration which would give a response of twice the noise level. The noise level was determined as the long term peak to peak deviation from the average baseline.

The syringe pump response was also used to calculate steady state concentrations and permeation rates for those chemicals where breakthrough was observed. Breakthrough was observed for methylene chloride, trichloroethylene, and vinyl acetate before



the development of the syringe pump method for determining MDL'S. Permeation rates were determined for methylene chloride and trichloroethylene by trapping on adsorbent charcoal and analyzing by gas chromatography. The NIDSH method for determination of vinyl acetate called for trapping on Chromosorb 107 with thermal desorption. As an alternative, 500 ul samples were taken directly from the carrier gas exit stream and analyzed by GC with a 10:1 split to column. A standard was prepared in carbon disulfide and analyzed using a 1 ul injection.

Xylenol and naphthalene were tested by placing a few crystals in the challenge side of the permeation cell allowing the cell to become saturated with their vapors. MDL's were determined using the analogous cresol for xylenol and benzene for naphthalene.

Included in the 117 chemical CHRIS list were the mixtures gaspline, turpentine, nephtha, and trepsote. The pesticides included on the CHRIS list were not tested in their pure state, but as 25-50% solutions in petroleum distillates. MDL's for the mixtures were calculated using the smallest molecular weight of the components in the solution tested. This gave the largest MDL possible for the varying concentrations.

Nine chemicals were tested for breakthrough using ion chromatography as the method for analysis. The challenge side of the permeation cell was filled with the test chemical and the collection side was filled with deionized water. Samples were taken at 15 minute intervals for a total test time of three hours. Prior to sampling, 0.5 ml of deionized water was added to the collection cell. The syringe was flushed with the collection media 3-4 times to allow mixing before a 0.5 ml sample was taken. Standards and samples were analyzed on a Dionex 2000 ion chromatograph equipped with a ASA-4 column. MDL's were determined by diluting the standard to the lowest detectable level. A blank cell was run to determine background levels.

Sodium hydroxide and sodium hydrosulfide solutions were tested for breakthrough using atomic absorption of sodium as the method of analysis. The same sampling method as above was employed to take 1.0 ml samples. Certified atomic absorption standards from sodium chloride and the samples were analyzed on a Microtek Unicam SP-90 atomic absorption spectrophotometer. MDL's were determined by diluting the standard to the lowest detectable level. A blank cell was run to determine background levels.

A 30% solution of hydrogen peroxide was tested for breakthrough using a colorimetric method of analysis. One ml samples were taken as above. To each sample, standard and blank, 0.2 ml of 10mM ferrous ammonium sulfate and 0.1 ml of 2.5M potassium thiocyanate was added. The red colored reaction was



observed and the absorbance at 480nm was read on a Gilford 300 microsample spectrophotometer. The MDL was determined by diluting the standard to the lowest detectable level.

Acetonitrile, adiponitrile, and ethylene cyanohydrin were not detected by the photoionization detector. They were tested for breakthrough by trapping the collection gas on adsorbent charcoal for 15 minutes at a flow rate of 200 cc/min over three hours. The last sample was trapped for fifty minutes to assure breakthrough did not occur. The charcoal was desorbed in benzene and analyzed by gas chromatography. The MDL's were determined by diluting the standards to the lowest detectable level.

#### 3.0 RESULTS

The results of the completed test are included in the requisite format along with photocopies of actual recording copies. The following table summarizes the results for those chemicals which were tested with continuous photoionization detection and no breakthrough was observed.



Challenge Chemical	•	• •	ppm/mV Chemical	• •
1,1,2,2-Tetrachloroethane	11.70	.088	.083	.23
1,2-Dibromoethane	11.70	.094	.038	.10
1.2-Dichloroethane	11.70	.061	.057	.09
1,2-Dichloroethylether	11.70	.088	.091	.15
1,2-Dichloropropane	11.70	.085	.097	.31
1,3-Dichloropropene	11.70	.082	.069	.17
1,4-Dioxane	11.70	.094	.117	.38
2-Nitropropane	11.70	.080	.248	.59
Acetaldehyde	11.70	.082	NA	NA
Acetic acid	11.70	.065	7.780	35.46
Acetic Anhydride	11.70	.085	.178	.57
Acetone	11.70	<b>.0</b> 98	.414	1.16
Acetone Cyanohydrin	10.20	.001	.043	2.74
Acetyl Chloride	10.20	.001	35.460	35.46
Acrylac Acid	11.70	.00B	.325	.86
Allyl Alcohol	11.76	<b>.18</b> 0	.235	1.13
Aniline	11.70	.049	.164	.46
Menzene	11_70	.434	.028	-05
Senzyl Chloride	11.70	.185	.038	-11
Broaine	11.70	.038	.331	.53
Sutyl Acetate	11.70	.488	.106	.25
Butyl Acrylate	11.70	.088	.099	.22
Butylanine	11.70	.09B	.096	.32
Butyraldehyde	10.20	.001	.002	.29
Carbon Tetrachloride	11.70	.059	.114	.29
Chlordane	10.20	.001	.036	.26
Chlorobenzene	11.70	.085	.085	.20
Chloroform	11.70	.049	.102	.19
Chloropicrin	10.20	.001	.064	1.80
Creosote	10.20	.001	.030	.32
Cresol	11.70	.035	.019	.03
Crotonaldehyde	11.70	.088	.193	.62
Cumene Hydroperoxide	11.70	.082	.502	1.20
Cyclohexane	11.70	.082	.077	.25
Diethanolamine	11.70	.082	NA	NA
Diisopropylamine	11.70	.0B0	.109	.39
Dimethyl Sulfate	10.20	.001	.038	1.52
Dipropylanine	11.70	.089	.137	.22
Epichlorohydrin	11.70	.088	.234	.75
Ethion 4	10.20	.001	.001	.03
Ethyl Acetate	11.70	.106	.205	.49
Ethyl Acrylate	11.70	.094	.307	1.72
Ethyl Alcohol	11.70	.096	.895	2.86
Ethyl Benzene	11.70	.089	.075	.14
Ethyl Ether	10.20	.001	.001	.13
Ethylamine 70%	11.70	.091	.206	.74
Ethylene Siycol	11.70	.085	.469	2.63
Ethylenediamine	11.70	.080	.870	2.78
Formaldehyde 37%	11.76	.094	NA	NA
Furfural	10.20	.061	.001	.08



Challenge Chemical		pps/sV Toluene	ppe/sV Chemical	MDL (ppa)
Sasoline	10.20	.001	.007	.16
<b>Glutara</b> ldehyde	10.20	.001	.013	.43
Hexane	11.70	.094	.089	.25
Hydrazine hydrate	10.20	.001	.023	.09
Isopropyl Alcohol	11.70	.080	.241	1.16
Isopropylanine	11.70	.094	.327	1.57
Malathion (50%)	10.20	.001	.129	1.03
Methyl Acrylate	10.20	.001	.151	.48
Hethyl Alcohol	11.70	.085	.519	4.07
Methyl Ethyl Ketone	11.70	.091	.311	.65
Methyl Isobutyl Ketone	11.70	.104	1.212	3.98
Methyl Methacrylate	11.70	<b>.08</b> 0	.117	.19
Methyl Parathion (44.0%)	10.20	.001	.002	.03
n-Butylalcohol	11.70	.098	.147	.32
n-Propyl Alcohol	10.20	.001	.012	.76
n-Propylacine	11.76	.073	.307	.74
Naled	10.20	.001	NA	NA
Maphtha	10.20	.001	.420	4.55
Naphthalem	10.20	-001	.001	.82
Nitrobenzene	11.70	.033	.051	.0B
o-Toluidine	11.70	.434	.185	.43
Parathion (45.07%)	10.20	.001	.002	.01
PCBs	10.20	.001	.001	.02
Pheno 1	11.70	.034	.020	.03
Propionic Acid	10.20	.001	.024	.31
Styrene	11.70	. 025	.020	.05
Tetrachloroethylene	11.70	.082	.033	.11
Toluene	11.70	.024	.026	.06
Tolylene 2,4-diisocyanate	11.70	.046	.206	.69
Trichloroethane	11.70	.088	.167	.60
Turpentine	10.20	.001	.0005	.03
Vinylidene Chloride	10.20	.001	.003	.49
lylene	11.70	.100	.072	.13
Tylenol	10.20	.001	.001	.01

MDL's were not determined for acetaldehyde, formaldehyde, diethanolamine, and naled. Acetaldeyhde has a boiling point of 21C and therefore was too volatile to place in the syringe. The formaldehyde solution was 63% water which had a quenching effect on the detector. Diethanolamine and naled were too viscous to load into the syringe.

Breakthrough was observed for eight chemicals. The following table gives the seven chemicals that broke through, their appropriate breakthrough times, steady state permeation rates, and MDL's.



Chearcal	Noise	MDL	BT time	SS rate
	(Ve)	(ppe)	(min)	(ug/hr=ca2)
******************	*****	*****	*******	*********
Acrolein (Composite)	4	.12	44.0	2.37
Acrolein (Run 1)	5	.06	38.0	1.61
Acrylonitrile (Run I)	.80	.46	54.0	5.12
Acrylonitrile (Run II)	.80	.18	76.0	.86
Allyl Chlorice (Composite)	.80	.16	102.0	.67
Allyl Chloride (Run I)	.80	.16	165.6	.60
Carbon Disulfide (composite)	.80	.10	21.6	2.76
Carbon Disulfide (Run I)	.40	.05	20.5	3.65
Carbon Disulfide (Runll)	.40	.05	17.7	2.59
Methylene Chloride (Runl)	1.60	.27	46.8	1.37
Methylene Diferrisk (Menill)	. 24	.13	.50.4	.96
Methylene Chloride (RunIII)	1.00	.17	55.2	1.27
Prapylene Duide (Companide)	1.20	48	137.0	LAB
Propylete Buide (Run I)	OAS	1.01	170.0	1.09
Trichloroethylene (Run I)	.96	.07	143.0	2.04
Trichloroethylene (Run II)	1.40		154.0	2.04
Trichloroethylene (Run III)	1.28	.09	146.0	1.63
Vinyl Acetate (Composite)	1.00		74.0	3.30
Vinyl Acetate (Run I)	1.00	.21	137.0	3.73
•				

No breakthrough was observed for the chemicals tested using methods other than continuous photoionization detection. The following table gives the results.

CHEMICAL	NETHOD	STANDARD	RET. TIME	MDL
*******************	***************	***********	**********	*******
CHLORDSULFONIC ACID	ION CHROMATOGRAPHY	5 ppm SD2OHC1	2.08 ain	0.5 ppm
NITRIC ACID	ION CHROMATOGRAPHY	10 ppm nitrate	4.16 min	egg 5.0
OLEUM	ION CHROMATOGRAPHY	10 ppm sulfate	8.35 ain	0.2 pps
PHOSPHORIC ACID	ION CHROMATOGRAPHY	10 ppa phosphate	6.88 min	0.5 pps
PHOSPHOROUS DXYCHLORIDE	ION CHROMATOGRAPHY	5 ppe POC13	2.04 min	0.5 ppm
PHOSPHOROUS TRICHLORIDE	ION CHROMATOGRAPHY	5 ppm PC13	2.11 min	0.5 pps
SILICON TETRACHLORIBE	ION CHROMATOGRAPHY	5 ppa SiCl4	2.05 ain	0.5 ppa
SULFUR MONOCHLORIDE	ION CHROMATOGRAPHY	5 ppa \$2012	2.07 min	0.5 pps
SULFURIC ACID	ION CHROMATOGRAPHY	10 ppm sulfate	8.59 min	0.2 pps
SODIUM NYDROXIDE SOLN 50X	ATOMIC ABSORPTION	0.5-4.0 pps	MA	0.5 ppe
SODIUM HYDROSULFIDE SOLN 10X	ATOMIC ABSORPTION	0.5-4.0 ppm	MA	0.5 pps
ACETONITRILE	GAS CHROMATOGRAPHY	15.6 ppa	.02 min	0.6 pps
ADIPONITRILE	SAS CHRONATOGRAPHY	7.2 ppa	1.8 min	0.3 pps
ETHYLENE CYANDHYDRIN	GAS CHRONATOGRAPHY	11.9 ppa	2.48 ain	0.4 pps
NYDROGEN PEROXIDE 30%	COLORIMETRIC	0.6-6.0 ppa	MA	0.6 pps



#### 4.0 PLANS

Included in this report are the results from testing 97 different chemicals. Motor fuel antiknock compounds, tetraethyl lead, and tetramethyl lead were not available from the distributor at this time. It may be possible to acquire a small sample of tetramethyl lead within a few weeks and the chemical will be tested at that time. The pesticide, tetraethylpyrophosphate, is no longer manufactured and therefore was not tested. Hydrofluoric acid required fixturing to prevent the etching of glassware. Hydrogen fluoride, hydrogen cyanide, and methyl chloride are gaseous compounds and will be included in a separate task order covering gaseous chemicals.

The chemicals that broke through and show differences in breakthrough times and permeation rates between the composite and individual runs will be repeated. It is also planned to do permeation testing on ten different mixtures as soon as the list of mixtures is received. The testing of the seamed samples and visor samples will continue as scheduled.

. u	EZCKI PLION OF PROD	OCT EAME ONLED		
•	: TYPE: Teflon la	minated Momey		
1 2				
		E TEST: Unused, no vi	aible imperiors	
	CUNDITION BEFOR	Charles Consed, no vi	Sible imperfections	
4		Chemtab Corp.		
		ICATION: Challenge 51	00	
6				
	: NOMINAL THICKNE			
8		laterial was orange col	ored on one side and	buff colored on the
	other side.			
_				
. T	EST METHOD			
	TECTING   4000 45	CARV. Taura Bassarah In		Dand Austin TV
1		ORY: Texas Research In		
		OD: Continuous photoi	onization detection	with a 11.7 ev lamp.
	. TEMPERATURE: 22			
	. COLLECTION MEDI			
	. COLLECTION SYST			
		S: I inch cells were u		
7.	. DEVIATIONS FROM	ASTH FASO NETHOD: Flo	w rate to cells was	100cc/min
~	HALLENCE CUTMICAL	1 :	COMPONENT 2	: 3
. L	HALLENGE CHEMICAL	•	COMPONENT 2	
•	. CHEM NAME(s):	Santa Talahada .	N/A	: W/A
				N/A
	. CAS NUMBER(s):		N/A	: N/A
	. CONC. (IF MIX)	N/A :	N/A	
4	. CHEMICAL SOURCE		N/A	N/A
T	EST RESULTS	Reagent Grade :	N/A	:N/A
• 11	ESI KESULIS			
1	. DATE TESTED: Jur	ne 3 1986		
	. NUMBER OF SAMPLE		<del> </del>	
		E: No breakthrough was	observed after thre	e hours.
	. MIN DETECTABLE L		<u> </u>	
	. STEADY STATE PER			
	. SAMPLE THICKNESS		<del></del>	
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	9.	•		•
	10.	•		:
8	. OTHER OBSERVATION	)NS:		
_				
. S	OURCE OF DATA		1 2 1.00	£
	Samples we	ere run by Sylvia R. Co	oper on June 3, 198	0

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from colle to Ofandard gas

C.-11

4: MANUFACTURER: (5: PRODUCT IDENTIF) 6: LOT OR MANUFACTU 7: NOMINAL THICKNES	RIAL CODE: 068 E TEST: <u>Unused, no vis</u> Chemfab Corp. ICATION: Challenge 5100 URER DATE: N/A		buff colored on the
TEST METHOD		<b>;</b>	
2. ANALYTICAL METHO 3. TEMPERATURE: 22- 4. COLLECTION MEDION 5. COLLECTION SYSTI 6. OTHER CONDITIONS	JM: N2	nization detection w	erature = 60C.
CHALLENGE CHEMICAL	. 1 :	COMPONENT 2 :	3
1. CHEM NAME(s): 2. CAS NUMBER(s): 3. CONC. (IF MIX) 4. CHEMICAL SOURCE	64-19-7 N/A	N/A N/A N/A N/A	N/A N/A N/A N/A
TEST RESULTS  1. DATE TESTED: 9-13 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LOS 5. STEADY STATE PERI 6. SAMPLE THICKNESS 7. SELECTED DATA PO	TESTED: Three : N/A IMIT 35.46 ppm MEATION RATE N/A : 18-20 mil		*,
TIME	CONCENTRATION	CONCENTRATION :	CONCENTRATION
2.			
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5. 6.			
7.			
9.			
10			
8. OTHER OBSERVATION	NS:		
SOURCE OF DATA Samples were	run by Denise McDonald	on September 13, 19	986

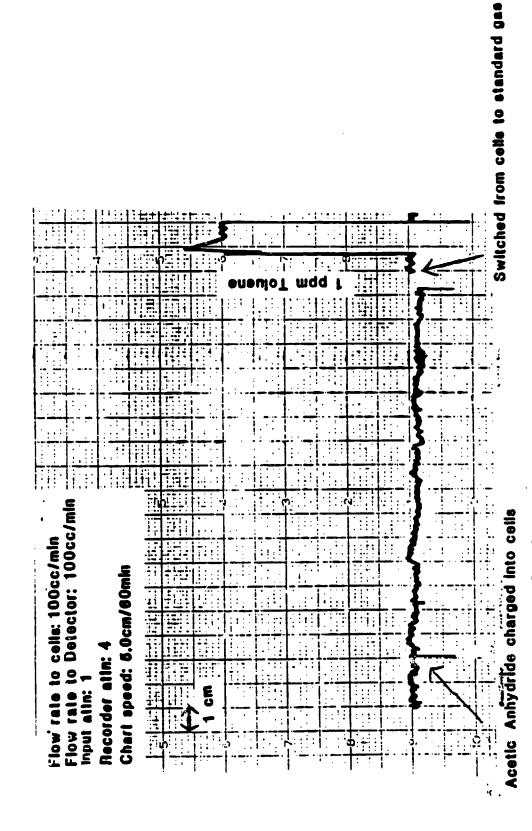
Chemical Resistance Testing of USCG Materal with Acetic Acid

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flow rate to nput atin: 1							12, 14	1

Acetic acid charged into cells

Switched from cells to standard gas

	SCRIPTION OF PRODUCT EVALUATED
1	TYPE: Teflon laminated Nomex
2	
3	CONDITION BEFORE TEST: Unused, no visible imperfections
4	
5	PRODUCT IDENTIFICATION: Challenge 5100
6	
7	NOMINAL THICKNESS: 15-20 mil
8	DESCRIPTION: Material was orange colored on one side and buff rolored on the
	other side.
. Т	ST METHOD
1	TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
2	ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp.
3	TEMPERATURE: 22-25°C
4	COLLECTION MEDIUM: No
5	COLLECTION SYSTEM: No
6	OTHER CONDITIONS: 1 inch cells were used. / Detector Temperature = 60C.
7	DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min.
	ALLENGE CHEMICAL 1 : COMPONENT 2 : 3
1	CHEM NAME(s): Acetic Amhydride : W/A : N/A
	CAS NUMBER(s): 108-24-7 : N/A : N/A
3	CONC. (IF MIX) N/A : N/A : N/A
4	
Т	grade : N/A : N/A ST RESULTS
1	DATE TESTED: June 28, 1986
	NUMBER OF SAMPLES TESTED: Three
3	BREAKTHROUGH TIME: No breakthrough was observed after 3 hours.
	MIN DETECTABLE LIMIT .57 ppm
	STEADY STATE PERMEATION RATE N/A
	SAMPLE THICKNESS: 18-19 mil
7	SELECTED DATA POINTS N/A
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION :
	2.
	<del>*</del> ,
	5.
	žii
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	9
	10
8	OTHER OBSERVATIONS:
S	URCE OF DATA
	Samples were run by Sylvia Cooper on June 28, 1986.



1.	DES	SCRIPTION O	F PROD	UCT EVALL	ATED				
	1: 2: 3: 4: 5: 6: 7: 8:	PRODUCT II LOT OR MAI NOMINAL TI	E MATES BEFORE RER: ( DENTIF! NUFACTE HICKNES	RIAL CODE TEST: Chemfab C CATION: JRER DATE	: 068 Unused, no orp. Challenge : N/A	5100	e imperfecti on one side		ff colored on the
2.	TES	T METHOD							
	4. 5.	TEMPERATUR COLLECTION COLLECTION OTHER COND	E: 22- I MEDIU I SYSTE	25°C M: N <sub>2</sub> M: N <sub>2</sub>	th colle		ute, 9063 Beation detection.	ION WIT	Road, Austin, TX n a 11.70 eV lamp.  sture = 600.
3.	CHAL	LENGE CHEM			1		MPONENT 2	_	3
4.	3. 4. TEST 1. D 2. N 3. B 4. M 5. S 6. S	CHEM NAME ( CAS NUMBER CONC. (IF I CHEMICAL SI RESULTS  ATE TESTED: UMBER OF SI REAKTHROUGH IN DETECTAE TEADY STATE AMPLE THICK ELECTED DAT	(s): { MIX)   F OURCE: {	29, 1986 TESTED: No Bre 11 1.16 ATION RA	Three akthrough ppm IE N/A	: N : N : N	/A /A /A /A /A erved after :	3 nours	N/A N/A N/A N/A N/A
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;	B. OT	HER OBSERVA	ATIONS:			•		•	
- 5	SOURCI	E OF DATA Samples w	vere ru	n by Syl	via Cooper	on May	29, 1986.		

Flow rate to Detector: 100cc/mhn hppt attn: 1 Flow rute to cells: 100cc/mln Chart apoud: 6.0cm/60mh Recorder attn: E

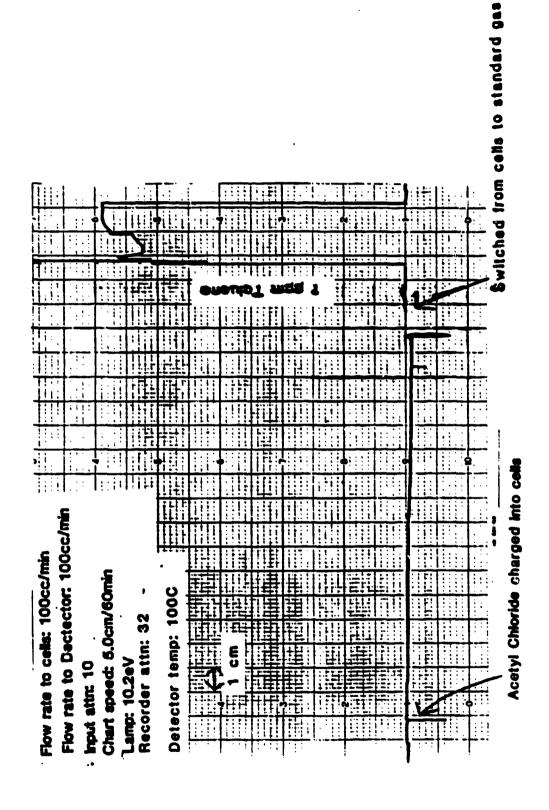
DE:	SCRIPTION OF PRO	DDUCT EVALUATED		
1:		laminated Nomex		
2:		TERIAL CODE: 068		
3:	CONDITION BEF	ORE TEST: Unused, no	visible imperfections	
4:	MANUFACTURER:	Chemfab Corp.	77.	
5:		IFICATION: Challenge	5100	
6: 7:		CTURER DATE: N/A NESS: 15-20 mil		
8:		Material was orange of	olored on one side an	d buff colored on the
٥.	other side.	Haterial was orange t	STOTES ON ONE SINE AN	DUTT COTOTED OIL CHE
TE	ST METHOD			
1.	TESTING LABOR	ATORY: Texas Research	Institute, 9063 Bee Co	aves Road, Austin, TX
2.	ANALYTICAL MET	HOD: Continuous phot	<u>oionization detection</u>	with a 10.2 eV lamp.
3.	TEMPERATURE: COLLECTION ME			
4. 5.	COLLECTION SY			· · · · · · · · · · · · · · · · · · ·
.i.		ONS: 1 inch cells wer	e used / Detector Tem	perature # 1000
7.	DEVIATIONS FR	OM ASTM F739 METHOD:	Flow rate to cells was	s 100cc/min.
CH	ALLENGE CHEMICA	. 1	: COMPONENT 2	3
1.		Acetone Cyanohydrin		N/A
2.			:N/A	: N/A
3. 4.	CONC. (IF MIX CHEMICAL SOUR		: N/A : N/A	N/A N/A
	ST RESULTS			,6 ,1
1.	DATE TESTED: Se	eptember 22, 1986	· <del></del>	
		ES TESTED: Three		
3.	BREAKTHROUGH T	IME: N/A	···	
<b>4.</b>	STEADY STATE DE	LIMIT 2.74 ppm ERMEATION RATE N/A		
6	SAMPLE THICKNES	S. 19-20 mil		
	SELECTED DATA			
	TIME 1.	: CONCENTRATION	: CONCENTRATION	: CONCENTRATION
	2.		•	•
	3			
	5.			:
	6. 7.		<u> </u>	:
	8.	:	•	•
	9.	:	•	•
	10	:		:
8.	OTHER OBSERVAT	ions:		
	·····			
SO	JRCE OF DATA			
301		were run by Fenise Mo	Donald on September 2	2, 1986.

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te to cells: 100 te to Detector: ttn: 10 peed: 5.0cm/60mi 0.2 eV r attn: 32 r temp: 100C								
ate to cells: 100 ate to Detector: attn: 10 speed: 5.0cm/60mi 10.2 eV er attn: 32 or temp: 100C								
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ow rate to cells: 100 ow rate to Detector: put attn: 10 art speed: 5.0cm/60mi mp: 10.2 eV corder attn: 32 tector temp: 100C								•
ow rate to cells: 100 ow rate to Detector: put attn: 10 art speed: 5.0cm/60mi mp: 10.2 eV corder attn: 32 tector temp: 100C								•

1. DESCRIPTION OF PRODUCT EVALUATED

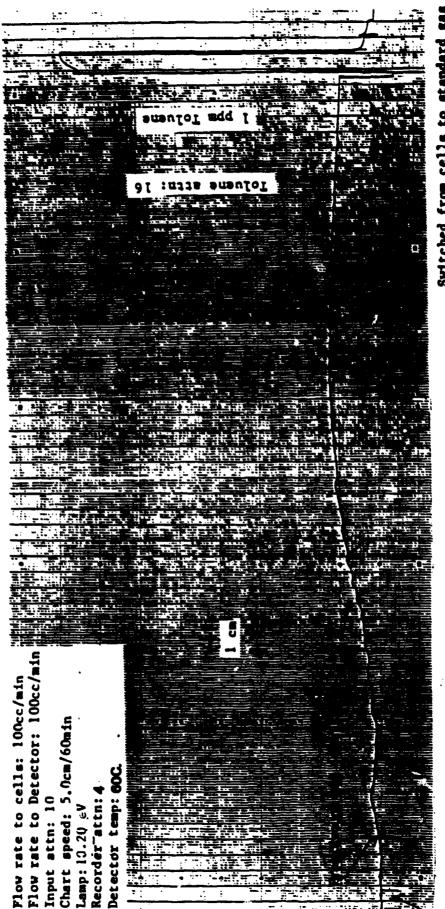
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.
2.	TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Gas Chromatography 3. TEMPERATURE: Ambient 4. COLLECTION MEDIUM: Charcoal 5. COLLECTION SYSTEM: Charcoal 6. OTHER CONDITIONS: One inch cells were used. 7. DEVIATIONS FROM ASTM F739 METHOD:
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
4.	1. CHEM NAME(s): Acetonitrile : N/A : N/A  2. CAS NUMBER(s): 2206-26-0 : N/A : N/A  3. CONC. (IF MIX) N/A : N/A : N/A : N/A  4. CHEMICAL SOURCE: Fisher-Pesticide : N/A
	1. DATE TESTED: October 9, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT 0.6 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS Cells 1,2 and 3 at end of three hour test.
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
:	1. 3 hours : <0.6 ppm
	3
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	6. 7.
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	9. : : : : : : : : : : : : : : : : : : :
	10:
	8. OTHER OBSERVATIONS: 3 hour samples were collected for 50 minutes for a total volume of 10 liters.
5.	SOURCE OF DATA Samples were run by Denise McDonald on October 9, 1986.

1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex
	2: PROTECTIVE MATERIAL CODE: 068
	3: CONDITION BEFORE TEST: Unused, no visible imperfections
	4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100
	6: LOT OR MANUFACTURER DATE: N/A
	7: NOMINAL THICKNESS: 15-20 mil
	8: DESCRIPTION: Material was orange colored on one side and buff colored on the
	other side.
2.	TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp.
	3. TEMPERATURE: 22-25°C
	4. COLLECTION MEDIUM: N2
	5. COLLECTION SYSTEM: N <sub>2</sub> 6. OTHER CONDITIONS: 1 inch cells were used./Detector Temperature =100C.
	7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min.
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. CHEM NAME(s): Acetyl Chloride : N/A : N/A
	2. CAS NUMBER(s): 75-36-5 : N/A : N/A
	3. CONC. (IF MIX) N/A : N/A : N/A
	4. CHEMICAL SOURCE: Aldrich reagent : N/A : N/A
4.	grade : N/A : N/A TEST RESULTS
••	
	1. DATE TESTED: August 13, 1986
	2. NUMBER OF SAMPLES TESTED: Three
	3. BREAKTHROUGH TIME: No breakthrough was observed after 3.1 hours 4. MIN DETECTABLE LIMIT 35.46 ppm
	5. STEADY STATE PERMEATION RATE N/A
	6. SAMPLE THICKNESS: 18-19 mil
	7. SELECTED DATA POINTS N/A
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
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	8. OTHER OBSERVATIONS:
5.	SOURCE OF DATA
٠.	Samples were run by Sylvia R. Cooper on August 13, 1986.



1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068
	3: CONDITION BEFORE TEST: Unused, no visible imperfections
	4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100
	6: LOT OR MANUFACTURER DATE: N/A
	7: NOMINAL THICKNESS: 15-20 mil
	8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.
2.	TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous photoiomization detection with a 10.20 eV lamp
	3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2
	5. COLLECTION SYSTEM: No
	6. OTHER CONDITIONS: 1 inch cells were used./Detector Temperature = 100C.
	7. DEVIATIONS FROM ASTM F/39 METHOD: Flow rate to cells was 100 cc/min.
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. CHEM NAME(s): Acrolein (composite): N/A : N/A
	2. CAS NUMBER(s): 107-02-8 : N/A : N/A
	3. CONC. (IF MIX) N/A : N/A : N/A
	4. CHEMICAL SOURCE: Kodek reagent : N/A : N/A
4:	TEST RESULTS : N/A : N/A
	1. DATE TESTED: October 6, 1986
	2. NUMBER OF SAMPLES TESTED: Three
	3. BREAKTHROUGH TIME: 44 minutes
	4. MIN DETECTABLE LIMIT .12 ppm
	5. STEADY STATE PERMEATION RATE 2.37 ug/cm=+hour
	6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
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	8. OTHER OBSERVATIONS:
5.	SOURCE OF DATA
	Samples were run by Denise McDonald on October 6, 1986

Chemical Resistance Testing of USCG Material with Acrolein



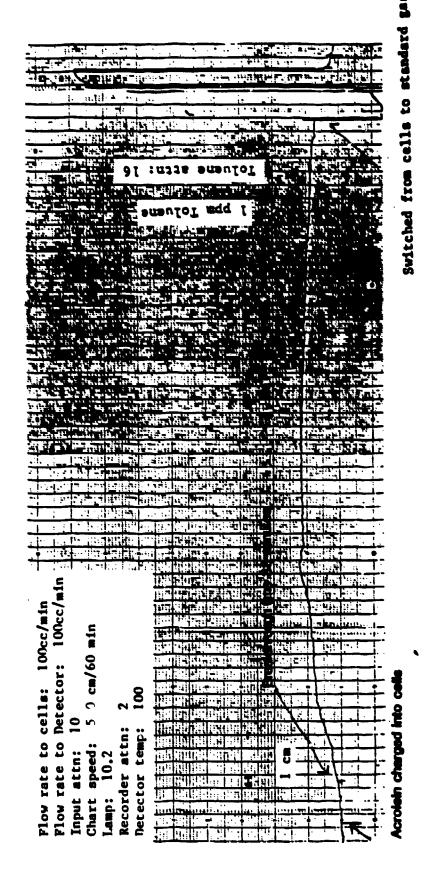
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1.	1. DESCRIPTION OF PRODUCT EVALUATED	
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenga 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff color	
	8: DESCRIPTION: <u>Material was orange colored on one side and buff color other side.</u>	ed on the
2.	2. TEST METHOD	
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, A 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.3 3. TEMPERATURE: 22-25 C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cells were used. /Detector Temperature = 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells were 100 cc/mi	0 eV lamp
3.	3. CHALLENGE CHEMICAL 1 : CONFONENT 2 : 3	<b>;</b>
4.	2. CAS MUMBER(\$): 107-02-8	1/A 1/A 1/A 1/A 1/A
	3. BREAKTHROUGH TIME: 38 minutes 4. MIN DETECTABLE LIMIT .06 ppm 5. STEADY STATE PERMEATION RATE 1.61 ug/cm² *hour 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A	
	TIME : CONCENTRATION : CONCENTRATION : CONCENT	RATION
	2. 3.	
	4. 5.	
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	8. OTHER OBSERVA" IONS:	
5.	5. SOURCE OF DATA Samples were run by Denise McDonald on October 8, 1986.	

# Chemical Resistance Testing of USCG Material with Acrolein

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1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex
	2: PROTECTIVE MATERIAL CODE: 068
	3: CONDITION BEFORE TEST: Unused, no visible imperfections
	4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100
	6: LOT OR MANUFACTURER DATE: N/A
	7: NOMINAL THICKNESS: 15-20 mil
	8: DESCRIPTION: Material was orange colored on one side and buff colored on the
	other side.
2.	TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp.
	3. TEMPERATURE: 22-25°C
	4. COLLECTION MEDIUM: N <sub>2</sub>
	5. COLLECTION SYSTEM: N <sub>2</sub>
	6. OTHER CONDITIONS: 1 inch cell was used. /Detector Temperature = 100C. 7. DEVIATIONS FROM ASIM F739 METHOD: Flow rate to cell was 100 cc/min.
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. CHEM NAME(s): Acrolein : N/A : N/A
	2. CAS NUMBER(s): 107-02-8 : N/A : N/A
	3. CONC. (IF MIX) N/A : N/A : N/A
	4. CHEMICAL SOURCE: Kodak : N/A : N/A
4.	TEST RESULTS  1. DATE TESTED: 1-22-87  2. NUMBER OF SAMPLES TESTED: One (Run II)
	3. BREAKTHROUGH TIME: 45 minutes
	4. MIN DETECTABLE LIMIT .17 ppm
	5. STEADY STATE PERMEATION RATE 2.82 (ug/cm²*hr)
	6. SAMPLE THICKNESS: 19-20 mils
	7. SELECTED DATA POINTS N/A
	TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION::
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	8. : : :
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	10. : : :
	3. OTHER OBSERVATIONS:
5.	SOURCE OF DATA
	Sample was run by Denise McDonald on January 22, 1987

Chemical Resistance Testing of Challenge 5100 Material

## Acrolein Run II

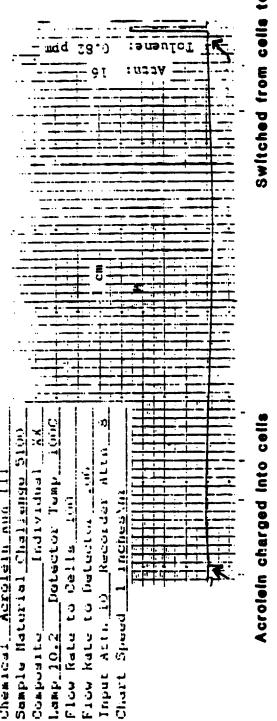
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rolein Run II cells: 100 Detector: 100 10 10 10 10 100 INDIVIDUAL Cells
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Chemical: Acrolein Run II Flow rate to cells: 100 Flow rate to Detector: 100 Chart speed: 2 in/hr Lamp: 10.2 Recorder attn: 8 Detector temp: 100 CHALLENGE 5100, INDIVIDUAL

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	1: 2: 3:	PROTECTIVE MATERIAL CODE: 068 CONDITION BEFORE TEST: Unuse		
	<b>4:</b> 5:	MANUFACTURER: Chemfab Corp. PRODUCT IDENTIFICATION: Challed	llenge 5100	
	<b>6</b> :	LOT OR MANUFACTURER DATE: N/A		
	7: 8:		range colored on one side and	buff colored on the
	0:	other side.	tange colored on one side and	part colored on the
	TES	ST METHOD		
		TESTING LABORATORY: Texas Res	search Institute, 9063 Bee Cav	es Road, Austin, T
	2.	ANALYTICAL METHOD: Continuou		
		TEMPERATURE: 22-25°C		
		COLLECTION MEDIUM: N2 COLLECTION SYSTEM: N2		<del> </del>
		OTHER CONDITIONS: 1 inch ce	ell was used. / Detector Temper	ature = 100C.
	7.	DEVIATIONS FROM ASTM F739 ME	THOD: Flow rate to cell was l	00 cc/min.
ı	CHA	ALIENGE THEMICAL 1	: COMPONENT 2 :	3
	, 	CHEM NAME(s): Acrolein	: N/A :	N/A
		CAS MIMBER(s): 107-02-8	: N/A :	N/A
	3.	CONC. (IF MIX) N/A	: N/A	N/A
	3. i.	CHEMICAL SOURCE: Kodak	: N/A :: N/A ::	N/A N/A
	3. TES 1. 2. 3. 4.	CHEMICAL SOURCE: Kodak  TRESULTS  DATE TESTED: 3-6-87  NUMBER OF SAMPLES TESTED: One BREAKTHROUGH TIME: N/A MIN DETECTABLE LIMIT .43 ppr STEADY STATE PERMEATION RATE	: N/A : e (Run III) n N/A	
	3. TES 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Kodak  TRESULTS  DATE TESTED: 3-6-87  NUMBER OF SAMPLES TESTED: One BREAKTHROUGH TIME: N/A  MIN DETECTABLE LIMIT .43 ppr STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 19-20 mils	: N/A : e (Run III) n N/A	
	3. TES 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Kodak  TRESULTS  DATE TESTED: 3-6-87  NUMBER OF SAMPLES TESTED: One BREAKTHROUGH TIME: N/A  MIN DETECTABLE LIMIT .43 ppr STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 19-20 mils SELECTED DATA POINTS N/A	: N/A :	N/A
	3. TES 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Kodak  TRESULTS  DATE TESTED: 3-6-87  NUMBER OF SAMPLES TESTED: One BREAKTHROUGH TIME: N/A  MIN DETECTABLE LIMIT .43 ppr STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 19-20 mils	: N/A :	
	TES 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Kodak  TRESULTS  DATE TESTED: 3-6-87  NUMBER OF SAMPLES TESTED: One BREAKTHROUGH TIME: N/A  MIN DETECTABLE LIMIT .43 ppr STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 19-20 mils SELECTED DATA POINTS N/A  TIME : CONCENT 1. : 2.	: N/A :	N/A
	3. 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOURCE: Kodak  TRESULTS  DATE TESTED: 3-6-87  NUMBER OF SAMPLES TESTED: One BREAKTHROUGH TIME: N/A  MIN DETECTABLE LIMIT .43 ppr STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 19-20 mils SELECTED DATA POINTS N/A  TIME: CONCENT 1	: N/A :	N/A
	3. 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOURCE: Kodak  TRESULTS  DATE TESTED: 3-6-87  NUMBER OF SAMPLES TESTED: One BREAKTHROUGH TIME: N/A  MIN DETECTABLE LIMIT .43 ppr STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 19-20 mils SELECTED DATA POINTS N/A  TIME: CONCENT 1	: N/A :  P (Run III)  N/A  TRATION : CONCENTRATION :  :	N/A
	3. TES 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOURCE: Kodak  TRESULTS  DATE TESTED: 3-6-87  NUMBER OF SAMPLES TESTED: One BREAKTHROUGH TIME: N/A  MIN DETECTABLE LIMIT .43 ppr STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 19-20 mils SELECTED DATA POINTS N/A  TIME: CONCENT 1	: N/A :	N/A
	3. TES 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOURCE: Kodak  TRESULTS  DATE TESTED: 3-6-87  NUMBER OF SAMPLES TESTED: One BREAKTHROUGH TIME: N/A  MIN DETECTABLE LIMIT .43 ppr STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 19-20 mils SELECTED DATA POINTS N/A  TIME: CONCENT 1	: N/A :  P (Run III)  N/A  TRATION : CONCENTRATION :  :	N/A
	3. TES 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOURCE: Kodak  TRESULTS  DATE TESTED: 3-6-87  NUMBER OF SAMPLES TESTED: One BREAKTHROUGH TIME: N/A  MIN DETECTABLE LIMIT .43 ppr STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 19-20 mils SELECTED DATA POINTS N/A  TIME : CONCENT 1	: N/A :  P (Run III)  N/A  TRATION : CONCENTRATION :  :	N/A
	3. 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOURCE: Kodak  TRESULTS  DATE TESTED: 3-6-87  NUMBER OF SAMPLES TESTED: One BREAKTHROUGH TIME: N/A  MIN DETECTABLE LIMIT .43 ppr STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 19-20 mils SELECTED DATA POINTS N/A  TIME: CONCENT 1	: N/A :  P (Run III)  N/A  TRATION : CONCENTRATION :  :	N/A
	3. 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOURCE: Kodak  TRESULTS  DATE TESTED: 3-6-87  NUMBER OF SAMPLES TESTED: One BREAKTHROUGH TIME: N/A  MIN DETECTABLE LIMIT .43 ppr STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 19-20 mils SELECTED DATA POINTS N/A  TIME : CONCENT 1	: N/A :  P (Run III)  N/A  TRATION : CONCENTRATION :  :	N/A
	3. 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOURCE: Kodak  TRESULTS  DATE TESTED: 3-6-87  NUMBER OF SAMPLES TESTED: One BREAKTHROUGH TIME: N/A  MIN DETECTABLE LIMIT .43 ppr STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 19-20 mils SELECTED DATA POINTS N/A  TIME : CONCENT 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	: N/A  (Run III)  N/A  IRATION : CONCENTRATION :  : : : : : : : : : : : : : : : : : :	N/A
	3. 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOURCE: Kodak  TRESULTS  DATE TESTED: 3-6-87  NUMBER OF SAMPLES TESTED: One BREAKTHROUGH TIME: N/A  MIN DETECTABLE LIMIT .43 ppr STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 19-20 mils SELECTED DATA POINTS N/A  TIME : CONCENT 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	: N/A :  P (Run III)  N/A  TRATION : CONCENTRATION :  :	N/A

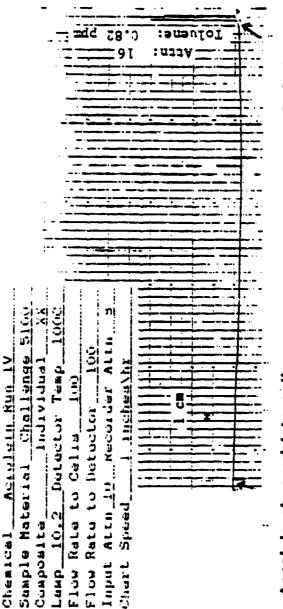
### Chemical Resistance Testing of Challenge 5100

### Acrolein Run III



### Chemical Resistance Testing of Challenge 5100

### Acrolein Run IV



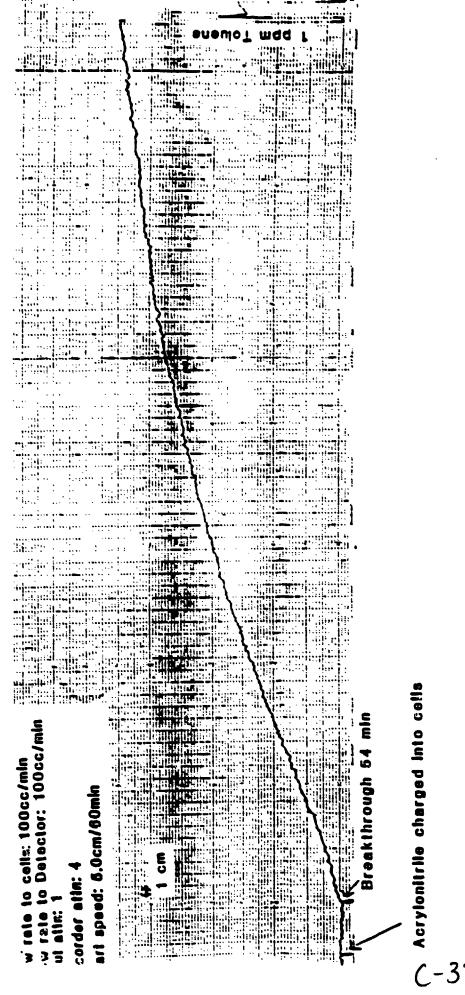
	1: TYPE: Teflon laminate 2: PROTECTIVE MATERIAL (	ODE: 068			
	3: CONDITION BEFORE TEST 4: MANUFACTURER: Chemfa	I: Unused, no vis	sible imperfection	18	
	4: MANUFACTURER: Chemfa 5: PRODUCT IDENTIFICATION	ON: Challenge 510	00		
	6: LOT OR MANUFACTURER I	DATE: N/A			
	7: NOMINAL THICKNESS:				
	8: DESCRIPTION: Materia	al was orange col	ored on one side a	and buff colo	red on the
•	TEST METHOD				
	1 TOTAL CALL DODA MODUL				A
	1. TESTING LABORATORY: 1 2. ANALYTICAL METHOD: (				
	3. TEMPERATURE: 22-25°C		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
	4. COLLECTION MEDIUM:	No.			
	5. COLLECTION SYSTEM:	N2	· · · · · · · · · · · · · · · · · · ·		000
	6. OTHER CONDITIONS: 7. DEVIATIONS FROM ASTM	F739 METHOD: F1	ow rate to cell w	mperature = 1 as 100 cc/min	•
L	TENLING CHEMICAL	1 :			3
		:		:	
	1. CHEM NAME(s): Acro		N/A		N/A
	2. CAS NIMBER(s): 107- 3. CONC. (IF MIX) N/A		N/A N/A		N/A N/A
	4. CHEMICAL SOURCE: Aldr:	ich :	N/A		N/A
	1. DATE TESTED: 3-7-87 2. NUMBER OF SAMPLES TEST 3. BREAKTHROUGH TIME: 1 4. MIN DETECTABLE LIMIT 5. STEADY STATE PERMEATION 6. SAMPLE THICKNESS: 19 7. SELECTED DATA POINTS	N/A .46 ppm ON RATE N/A -20 mils	)		
	TIME :	CONCENTRATION	: CONCENTRATION	N : CONCEN	TRATION
		<del></del>	:		
	2.			:	
	3		•		
	3. : 4. :				
	3. : 4. : 5. :		:		
	3. : 4. :		:		
	3. : 4. : 5. : 6. :				
	3. : : : : : : : : : : : : : : : : : : :				
	3. : : : : : : : : : : : : : : : : : : :				
	3. : : : : : : : : : : : : : : : : : : :				

1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp.
	5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil
	8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.
2.	TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: No 5. COLLECTION SYSTEM: No 6. OTHER CONDITIONS: 2 inch cells were used. /Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min.
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. CHEM NAME(s): Acrylic Acid : N/A : N/A
	2. CAS NUMBER(s): 79-10-7 : N/A . : N/A
	3. CONC. (IF MIX) N/A : N/A : N/A
	4. CHEMICAL SOURCE: Aldrich reagent : N/A : N/A
4.	TEST RESULTS : N/A : N/A
	1. DATE TESTED: May 28, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after three hours. 4. MIN DETECTABLE LIMIT 0.86 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 18-20 mil. 7. SELECTED DATA POINTS N/A
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : :
	2
	4
	5
	7.
	ė. ————————————————————————————————————
	9.
	10
	8. OTHER OBSERVATIONS:
5.	SOURCE OF DATA Samples were run by Sylvia Cooper on May 28, 1986.

1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex
	2: PROTECTIVE MATERIAL CODE: 068
	3: CONDITION BEFORE TEST: Unused, no visible imperfections
	4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100
	5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A
	7: NOMINAL THICKNESS: 15-20 mil
	8: DESCRIPTION: Material was orange colored on one side and buff colored on the
	other side.
2.	TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
	- 2. ANAL HIGAL METHOD: CONTINUOUS DNOTOTONIZATION DETECTION WITH A 11.70 AV LARD.
	3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: No
	5. COLLECTION SYSTEM: No
	6. OTHER CONDITIONS: 2 inch cells were used. /Detector Temperature = 600.
	7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	I. CHEM NAME(s): Acrylonitrile (RunI): N/A : N/A
	1. CHEM NAME(s): Acrylonitrile (RunI): N/A : N/A 2. CAS NUMBER(s): 107-13-1 : N/A : N/A
	3. CONC. (IF MIX) N/A : N/A : N/A
	4. CHEMICAL SOURCE: Alarich : N/A : N/A
4.	reagent grade : N/A : N/A
4.	TEST RESULTS
	1. DATE TESTED: May 29, 1986
	2. NUMBER OF SAMPLES TESTED: Une (Run I)
	3. BREAKTHROUGH TIME: 54 min
	4. MIN DETECTABLE LIMIT 0.46 ppm 5. STEADY STATE PERMEATION RATE N/A
	6. SAMPLE THICKNESS: 18-20 mil
	7. SELECTED DATA POINTS N/A
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
	ž. ————————————————————————————————————
	3.
	4
	5
	6:::::::::
	8: — <u> </u>
	9: <del></del>
	10.
	9 OTHER (MCERVATIONS)
	8. OTHER OBSERVATIONS:
_	
5.	SOURCE OF DATA
	Simple was run by Sylvia Cooper in May 29, 1986

### Permeation of Acrylonitrile through USCG Material

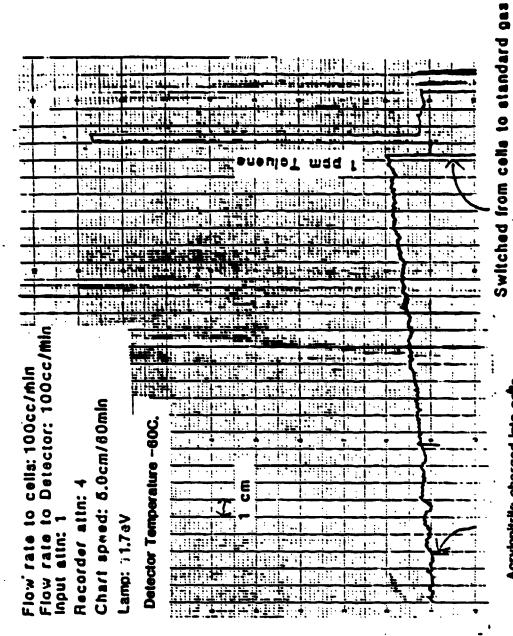
Run



1.	DESCRIPTION OF PRODUCT EVALUATED	
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no v 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange coother side.	
2.	TEST METHOD	
	1. TESTING-LABORATORY: Texas Research I 2. ANALYTICAL METHOD: Continuous photo 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: No 5. COLLECTION SYSTEM: No 6. OTHER CONDITIONS: 1 inch cells were 7. DEVIATIONS FROM ASTM F739 METHOD:	nstitute, 9063 Bee Caves Road, Austin, TX rionization detection with a 11.7 eV Tamp.  e used./ Detector Temperature = 60C.  Flow rate to cells was 100cc/min.
3.	CHALLENGE CHEMICAL 1	: COMPONENT 2 : 3
٠.	1. CHEM NAME(s): Acrylonitrile(RumII) 2. CAS NUMBER(s): 107-13-1 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Aldrich TEST RESULTS	N/A N/A N/A N/A N/A N/A N/A N/A N/A
	1. DATE TESTED: September 03, 1986 2. NUMBER OF SAMPLES TESTED: One 3. BREAKTHROUGH TIME: 76 minutes 4. MIN DETECTABLE LIMIT .18 ppm 5. STEADY STATE PERMEATION RATE 0.86 up 6. SAMPLE THICKNESS: 18-19 7. SELECTED DATA POINTS N/A	/cm² x hour.
	TIME : CONCENTRATION	: CONCENTRATION : CONCENTRATION
	1.	
	8. OTHER OBSERVATIONS:	
5.	SOURCE OF DATA Samples were run by Karen Yerscho	oor or September 03, 1986.

## Chemical Resistance Testing of USCG Material with Acrylonitrile

### Run =



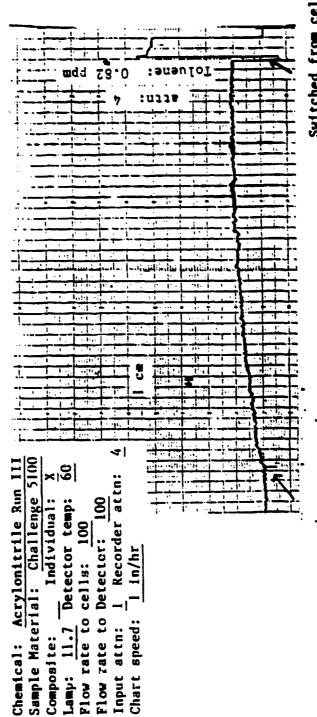
Acrylonitrile charged into cells

C-30

DE	SCRIPTION OF PRO	DUCT EVALUATED			
1:	TYPE: Teflon 1	aminated Nomex			
2		ERIAL CODE: 068			**************************************
_		RE TEST: Unused, no	visible imp	erfections	
4:			V 120101C 15P	4114661101110	
5		FICATION: Challenge	5100		
	LOT OR MANUFAC				
7:			·		
		Material was orange	colored on o	ne side and b	uff colored on the
	other side.				
T	EST METHOD				
1.	TESTING LABORA	TORY: Texas Research	n Institute.	9063 Bee Cave	s Road. Austin. TX
2.					th a 11.70 eV lamp
3.					
4.	COLLECTION MED	IUM: N <sub>2</sub>			
5.	COLLECTION SYS	TEM: N <sub>2</sub>	<del></del>		
6.	OTHER CONDITION	MS: I inch cell w	s used. Dete	ctor Temperat	ure = 60C.
	DEVIATIONS FRO	ASTM F739 METHOD:	Flow rate t	o cell was 10	O cc/min.
CE	IALLENCE CHEMICAL	1	: Confun	ENT 2 :	3
1.	CHEM NAME(s):	Aces lendered la	: : N/	<b>:</b> '▲	N/A
	CAS NIMBER(s):				N/A
	CONC. (IF MIX)		—:————————————————————————————————————		N/A
4.					N/A
2. 3. 4. 5.	DATE TESTED: 2 NUMBER OF SAMPL BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES	ES TESTED: One (Run ME: 45 minutes LIMIT .05 ppm RMEATION RATE .74	(ug/cm <sup>2</sup> *hr)		
	SELECTED DATA P				
	TIME	: CONCENTRATIO	ON : CONT	ENTRATION :	CONCENTRATION
	2.				
	3. 4.	:	<del>:</del>	<del></del>	
	5.	:			
	6.	:			
	8.	:	<u> </u>	<del></del>	<del></del>
	8.	<del>:</del>		<del></del>	
	9.	:			
Đ	ATUED ARCERULES	anc.			
٥.	CIRER UBSERVATIO	DNS:			<del></del>
SO	URCE OF DATA				
	Sample was	run by Denise McDona	ld on Februs	ry 11, 1987.	

### Chemical Resistance Testing of Challenge 5100

### Acrylonitrile Run



Acrylonitrille charged into cella

Switched from cells to standard gas

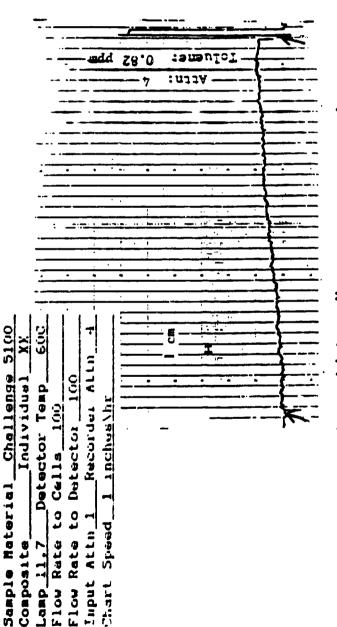
. ·	CONDITION BEFORE MANUFACTURER: Ch	TEST: Unused, no v	isible imperfection	ns
		ATION: Challenge 5	100	
	OT OR MANUFACTUR			
: 8	IOMINAL THICKNESS	: 15-20 mil		
		erial was orange co	lored on one side	and buff colored on t
_	other side.			
EST	METHOD			
:	TESTING LABORATOR	NY: Texas Research I	nstitute, 9063 Bee	Caves Road, Austin,
	NALTICAL METHOL			on with a 11.7 eV lan
-	TEMPERATURE: 22-3			
	COLLECTION MEDIUM			
	COLLECTION SYSTEM			
	THER CONDITIONS		used. /Detector Tem	
•	DEVIATIONS FROM A	ASIM F739 METHOD: F	low rate to cell w	as 100 cc/min.
HAI.	THOUMERS ESKE	1	COMPONENT 2	: 3
. (	CHEM NAME(s): A	Acrylonicrile	: : N/Å	: : N/A
	CAS NUMBER(s):		: N/A	: N/A
	ONC. (IF MIX)		: N/A	: N/A
	CHEMICAL SOURCE:		: N/A	: N/A
BI BI BI BI BI BI	ATE TESTED: 3-9 IMBER OF SAMPLES REAKTHROUGH TIME: IN DETECTABLE LIN READY STATE PERMI AMPLE THICKNESS:	TESTED: One (Run: 97 minutes		
'. SI	ELECTED_DATA POI	NTS N/A		
	TIME :	CONCENTRATION	: CONCENTRATIO	N : CONCENTRATION :
1.	:		:	:
2.	:		:	
2. 3.			<del></del>	:
2. 3. 4.				•
2. 3. 4. 5.	:		<del></del>	
2. 3. 4. 5.				
2. 3. 4. 5. 6. 7.				
2. 3. 4. 5. 6. 7.				
2. 3. 4. 5. 6. 7. 8.				
2. 3. 4. 5. 6. 7. 8.				

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### Chemical Resistance Testing of Challenge 5100

### Acrylonitrile Run IV

Chemical Acrylonitrile Run IV



Acrylonitrile charged into cells

Switched from cells to standard gas

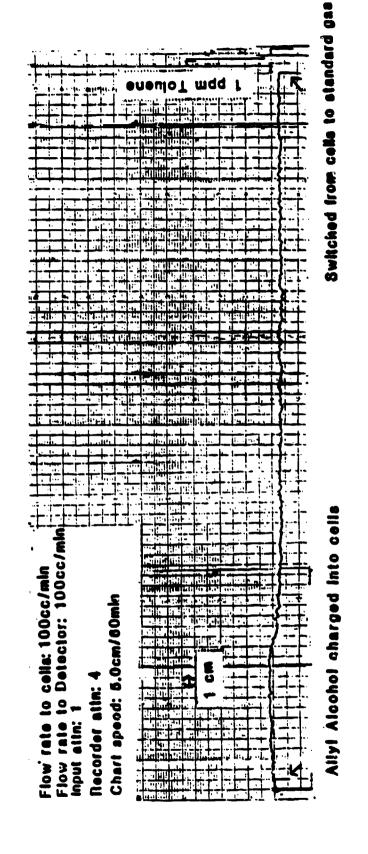
1.	DESCRIPTION OF PRODUCT EVALUATED		•
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no vi 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 51 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange col	00	ouff colored on the
	other side.	OTES OIL OILE STEE CITE	
2.	TEST METHOD		
	1. TESTING LABORATORY: Texas Research Ir 2. ANALYTICAL METHOD: Gas Chromatograph 3. TEMPERATURE: Ambient 4. COLLECTION MEDIUM: Charcoal 5. COLLECTION SYSTEM: Charcoal 6. OTHER CONDITIONS: One inch cells wer 7. DEVIATIONS FROM ASIM F/39 METHOD:	D.Y	es Road, Austin, TX
3.	CHALLENGE CHEMICAL 1	COMPONENT 2 :	3
4.	1. CHEM NAME(s): Adiponitrile 2. CAS NUMBER(s): 111-69-3 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Aldrich reagent grade  TEST RESULTS  1. DATE TESTED: October 8, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT 0.3 ppm 5. STEADY STATE PERMEATION RATE N/A	N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
	6. SAMPLE THICKNESS: 19-20 mils		
	7. SELECTED DATA POINTS Cells 1,2 and 3	at end of three hour t	test.
•	TIME : CONCENTRATION  1. 3 hours : <0.3 ppm  2. :	: CONCENTRATION : CO.3 ppm	CONCENTRATION <0.3 ppm
	4. : 5. :	<del>:                                    </del>	
	6		
	7. 8.		
	9		
	10		
	8. OTHER OBSERVATIONS: 3 hour samples we volume of 10 liters.	ere collected for 50 m	inutes for a total
5.	SOURCE OF DATA Samples were run by Denise McDon	ald on October 8, 1986	•

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1.	DESCRIPTION OF PRODUCT EVALUATED	
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no. 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange other side.	
2.	TEST METHOD	
	1. TESTING LABORATORY: Texas Research 2. ANALYTICAL METHOD: Continuous pho 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION SYSTEM: N <sub>2</sub> 6. OTHER CONDITIONS: 1 inch cells wer 7. DEVIATIONS FROM ASTM F739 METHOD:	n Institute, 9063 Bee Caves Road, Austin, TX otoionization detection with a 11.70 eV lamp.  re used. /Detector Temperature = 60C. Flow rate was 100cc/min
3	CHALLENGE CHEMICAL 1	: COMPONENT 2 : 3
	1. CHEM NAME(s): Allyl Alcohol 2. CAS NAMER(s): 107-18-6 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Aldrich Reagent Grade TEST RESULTS	N/A
	1. DATE TESTED: June 4, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No Breakthrough 4. MIN DETECTABLE LIMIT 1.13 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 18-20 mil 7. SELECTED DATA POINTS N/A	was detected after 14 hours.
	TIME : CONCENTRATIO	ON : CONCENTRATION : CONCENTRATION
	2.	
	3. 4.	<del>:</del>
	5. <u> </u>	
	7.	
	8.	
	ió	
	8. OTHER OBSERVATIONS:	
5.	Source of DATA  Samples were run by Karen Versch	noor on June 4-5, 1986

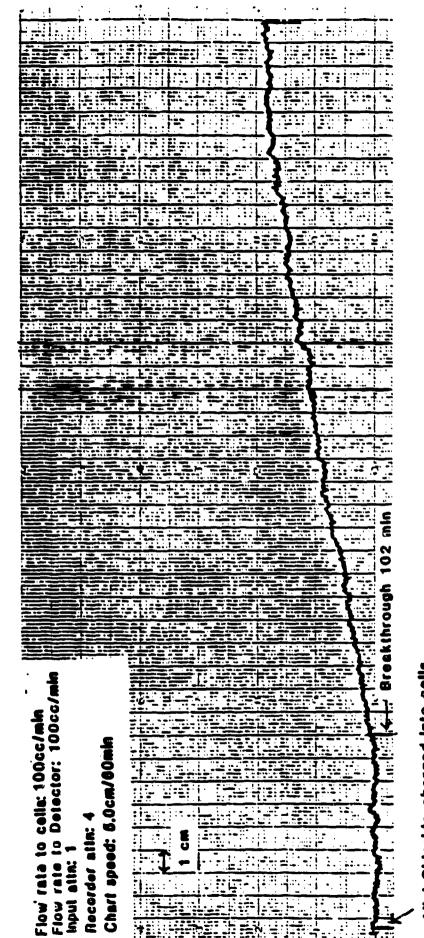
# Chemical Resistance Testing of USCG Material with Allyl Alcohol



	DESCRIPTION OF PROD					
	1: TYPE: Teflon 1: 2: PROTECTIVE MATE	ERIAL CODE: 068				_
		RE TEST: Unused, no	visible imperfection	ns		_
	4: MANUFACTURER: 5: PRODUCT IDENTIT	FICATION: Challenge	3100			_
	6: LOT OR MANUFACT	TURER DATE: N/A	7200			
	7: NOMINAL THICKNE					_
	8: DESCRIPTION: 1 other side.	Material was orange c	olored on one side a	and buff	colored on the	_
2.	TEST METHOD					
		TORY: Texas Research	institute, 9063 Bee	Caves R	oad, Austin, TX	-
	2. ANALYTICAL METH 3. TEMPERATURE: 22	HOD: Continuous photo 2-25°C	olonization detection	on Mitu	a II./U ev lamp.	_
	4. COLLECTION MED	IUM: N2		···		_
	5. COLLECTION SYS					_
	6. OTHER CONDITION	NS: <u>2 inch cells we</u> M ASTM F739 METHOD:	e used. /Detector	emperat	ure = 60C.	_
•	ENNLIEUE ENENICAL	_	: COMPONENT 2	482 100	3	-
<b></b> -			:	:	_	
	J. CHEN NAME(s): 2. CAS NAMBER(s):	107-051	N/A N/A	<u>-</u>	N/A N/A	-
	3. CONC. (IF MIX)		N/A	:	N/A	_
	4. CHEMICAL SCURC	E: Aldrich	: N/A	_:	N/A	_
	TEST RESULTS	reagent grade	: N/A		N/A	_ ·
	2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIP		iposite runj			_
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE & 5. STEADY STATE PER 6. SAMPLE THICKNESS	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mil				
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE 1 5. STEADY STATE PEN 6. SAMPLE THICKNESS 7. SELECTED DATA PO	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A	g/hr x cm²			-
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE I 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME 1.	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A  : CONCENTRATION	g/hr x cm²	۷ : 0	ONCENTRATION	-
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE II 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO	ME: 102 min LIMIT 0.16 ppm  RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A  : CONCENTRATION :	g/hr x cm²	v : 0	ONCENTRATION	-
•	3. BREAKTHROUGH TIN 4. MIN DETECTABLE 1 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME 1. 2. 3.	ME: 102 min LIMIT 0.16 ppm  RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A  : CONCENTRATION :	g/hr x cm²	N : 0	ONCENTRATION	
•	3. BREAKTHROUGH TIN 4. MIN DETECTABLE II 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO	ME: 102 min LIMIT 0.16 ppm  RMEATION RATE 0.64 up  S: 18-20 mil OINTS N/A  : CONCENTRATION : :	g/hr x cm²	V : C	ONCENTRATION	
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE II 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME 1. 2. 3. 4. 5. 6.	ME: 102 min LIMIT 0.16 ppm  RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A  : CONCENTRATION :	g/hr x cm²	V : C	ONCENTRATION	
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE II 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME 1. 2. 3. 4. 5. 6. 7. 8.	ME: 102 min LIMIT 0.16 ppm  RMEATION RATE 0.64 up S: 18-20 mil OINTS N/A  : CONCENTRATION :	g/hr x cm²	V : C	ONCENTRATION	
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE II 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	ME: 102 min LIMIT 0.16 ppm  RMEATION RATE 0.64 up S: 18-20 mil OINTS N/A  : CONCENTRATION :	g/hr x cm²	V : C	ONCENTRATION	
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE II 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME 1. 2. 3. 4. 5. 6. 7. 8.	ME: 102 min LIMIT 0.16 ppm  RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A  : CONCENTRATION :	g/hr x cm²	V : C	ONCENTRATION	
•	3. BREAKTHROUGH TIN 4. MIN DETECTABLE II 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	ME: 102 min LIMIT U.16 ppm  RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A  : CONCENTRATION :: :: ::	g/hr x cm²	V : C	ONCENTRATION	
	3. BREAKTHROUGH TIN 4. MIN DETECTABLE II 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	ME: 102 min LIMIT U.16 ppm  RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A  : CONCENTRATION :: :: ::	g/hr x cm²	V : 0	ONCENTRATION	
5.	3. BREAKTHROUGH TIN 4. MIN DETECTABLE II 5. STEADY STATE PER 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	ME: 102 min LIMIT U.16 ppm  RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A  : CONCENTRATION :: :: ::	g/hr x cm²	V : 0	ONCENTRATION	
5.	3. BREAKTHROUGH TIN 4. MIN DETECTABLE II 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.  8. OTHER OBSERVATION  SOURCE OF DATA	ME: 102 min LIMIT U.16 ppm  RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A  : CONCENTRATION :: :: ::	CCNCENTRATION	V : C	ONCENTRATION	
5.	3. BREAKTHROUGH TIN 4. MIN DETECTABLE II 5. STEADY STATE PEI 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.  8. OTHER OBSERVATION  SOURCE OF DATA	ME: 102 min LIMIT 0.16 ppm RMEATION RATE 0.64 u S: 18-20 mil OINTS N/A  : CONCENTRATION :: :: :: :: :: :: :: :: :: :: :: :: ::	CCNCENTRATION	V : C	ONCENTRATION	

### Permeation of Allyl Chloride through USCG Material

(Composite Run)



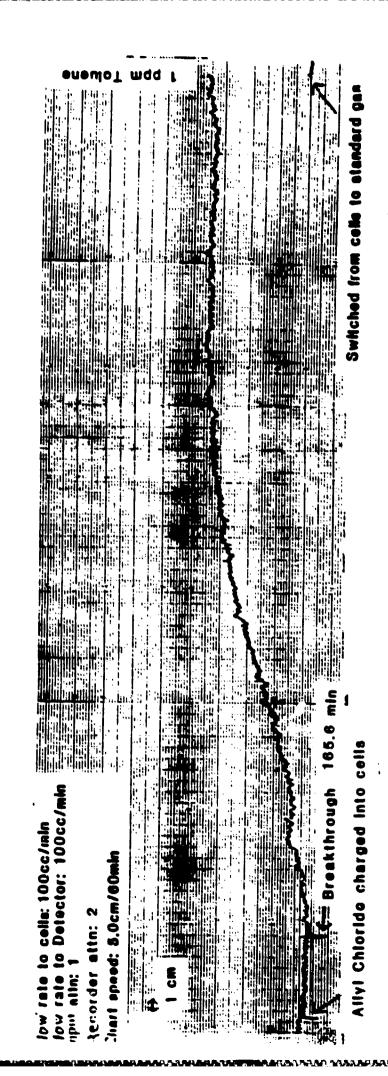
Ally! Chloride charged into cells

C-49

. DESC	KIPITUM OF PRODUCT EVALU	A! ED			
1:	TYPE: <u>Teflon</u> laminated N	omex			
2:	PROTECTIVE MATERIAL CODE	: 068			
	CONDITION BEFORE TEST:		ible imperfection	ne	
4:	1ANUFACTURER: Chemfab C	orp.		113	
5:	PRODUCT IDENTIFICATION:	Challenge 510	<u> </u>		
6:	LOT OR MANUFACTURER DATE	: N/A		· · · · · · · · · · · · · · · · · · ·	
	IOMINAL THICKNESS: 15-2				
8: 1	DESCRIPTION: Material w	as orange colo	red on one side	and buff c	olored on the
_	other side.		0- 0 0 0	31.0 3011 0.	or or ear on the.
. TEST	METHOD			1. · · · · · · · · · · · · · · · · · · ·	
1.	ESTING LABORATORY: Texa	s Research Ins	titute, 9063 Bee	Caves Road	d, Austin, TX
٤٠ . ١	ANALTIILAL MEIHUD: CONT	inuous photoin	nization detection	on with a l	1.70 eV lamp.
	EMPERATURE: 22-25°C				
	COLLECTION MEDIUM: N2				
6.			1 /6		
7.	NOTATIONS EDOM AS THE THE	Ch cell was us	ed /Detector Temp	perature =	60C.
/ •	DEVIATIONS FROM ASTM F73	A WELKON: FIO	rate to cell wa	s 100cc/m	in.
. CHALI	ENCE CHEMICAL	1 :	COMPONENT 2	:	3
1. 1	HEM NAME (s) : Allyl Ch	loride :	. N/A	•	N/A
2.	AS NUMBER(s): 107-051		N/A	<del></del>	N/A
	ONC. (IF MIX) N/A		N/A	<del>:</del>	N/A
4.	HEMICAL SOURCE: Aldrich	reagent	N/A	<del></del> :	N/A
	grade		N/A	—:·	N/A
. TEST	RESULTS	···································			11/1
1. DA	TE TESTED: June 13, 1				
	MBER OF SAMPLES TESTED:	One (Run I)			
3. Bi	EAKTHROUGH TIME: 165.6	min			
4. MI	N DETECTABLE LIMIT 0.16	ppm			
5. 31	EADY STATE PERMEATION R	ATE 0.62 ug/hr	X CM		
	MPLE THICKNESS: 18-21	631			
/. 30	LECTED DATA POINTS				
1	TIME : CO	NCENTRATION :	CONCENTRATION	: CONC	ENTRATION
2.				<del></del> _	
3.					~~~~~~
4.					
5.	•				
6.	<del></del>				
7.	•				
8.	<u> </u>	<del></del>		<del></del>	
9.				<del></del>	
			<del></del>	<del></del>	
8. OT	HER OBŠERVATIONS:				
. SOURC	E OF DATA				
	Sample was run by Sylv	<u>/ia cooper on J</u>	une 13, 1986.		

## Permeation of Allyl Chloride through USCG Material

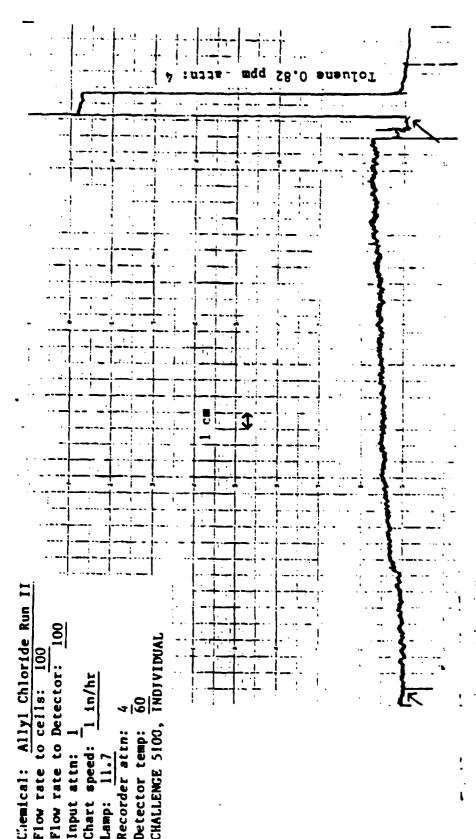
Run I



_	DESCRIPTION OF PRO	DUCT EVALUATED			
3	l: TYPE: Teflon :	laminated Nomex			•
		TERIAL CODE: 068	<del></del>		
		ORE TEST: Unused,	no visible imperfer	ctions	
		Chemfab Corp.	no visione appeared		
		IFICATION: Challen	54 5100	<del></del>	
-		CTURER DATE: N/A	AE 3100		
_		NESS: 19-20 mil			
				de and bu	66 aplaned as 1
C	other side.	Material was orang	e colored on one si	rds are bu	II coloted on
	<del></del>	<del></del>			
1	rest method				
1	. TESTING LABOR	ATORY: Texas Resear	ch Institute, 9063	Bee Caves	Road, Austin,
2	2. ANALYTICAL MET		hotoionization dete		
3	3. TEMPERATURE:				
4	4. COLLECTION ME				
	5. COLLECTION SY	" - · · · · · · · · · · · · · · · · · ·			
-	COMPLET COMPLETE		was used /Detector	Temperatu	re = 60C-
_		OM ASTM F739 METHOD			
٤	BALLENGE CEPHICAL	L 1	: COMPONENT 3	2 :	3
1	. CHEM NAME(s)	: Allyl Chloride	: : N/A	:	N/A
	CAS NUMBER(s)		N/A		N/A
	CONC. (IF MIX		N/A	:	N/A
_	. CHEMICAL SOUR		N/A	<del></del> :	N/A
3 4 5	2. NUMBER OF SAMPI 3. BREAKTHROUGH TI 4. MIN DETECTABLE 5. STEADY STATE PR	LIMIT .03 ppm ERMEATION RATE2	un II) 2 (ug/cm <sup>2</sup> *hr)		
•	6. SAMPLE THICKNES		····		النواسية سالوالية سياد بطوال
-	7. SELECTED DATA I	POINTS N/A			
7					
7	TIME 1.	: CONCENTRAT	ION : CONCENTRA	ATION :	CONCENTRATION
7	1	: CONCENTRAT	ION : CONCENTRA	ATION :	CONCENTRATION
7	1.	: CONCENTRAT	ION : CONCENTRA	ATION :	CONCENTRATION
7	1. 2. 3.	: CONCENTRAT	ION : CONCENTRA	ATION :	CONCENTRATION
7	1. 2. 3.	: CONCENTRAT	ION : CONCENTRA	ATION:	CONCENTRATION
7	1	: CONCENTRAT	ION : CONCENTRA	ATION:	CONCENTRATION
7	1	CONCENTRAT	ION : CONCENTRA	ATION:	CONCENTRATION
7	1	CONCENTRAT	ION : CONCENTRA	ATION:	CONCENTRATION
7	1	CONCENTRAT	ION : CONCENTRA	ATION:	CONCENTRATION
7	1	CONCENTRAT	ION : CONCENTRA	ATION:	CONCENTRATION
7	1	CONCENTRAT	ION : CONCENTRA	ATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	:	ION : CONCENTRAL : : : : : : : : : : : : : : : : : : :	ATION:	CONCENTRATION
	1	:	ION : CONCENTRA	ATION:	CONCENTRATION
	1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	:	ION : CONCENTRA	ATION:	CONCENTRATION

Chemical Resistance Testing of Challenge 5100 Material

### Allyl Chloride Run #



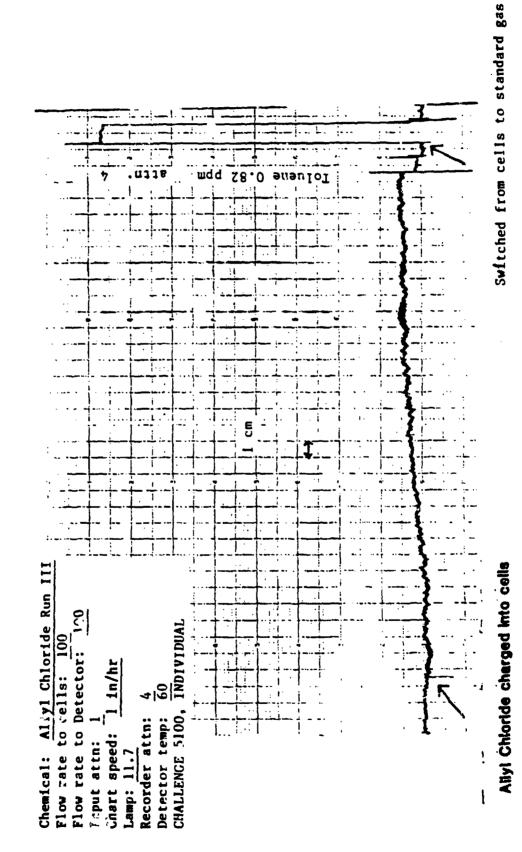
Allyi Chloride charged into cells

Switched from cells to standard gas

			Chemfab Corp.  IFICATION: Challenge	\$100	
			TURER DATE: N/A	3100	
	-		ESS: 19-20 mil		
		DESCRIPTION: _ other side.	Material was orange o	olored on one side and	buff colored on the
·	_	METHOD			
	1. 7	TESTING LABORA	TORY: Texas Research	Institute, 9063 Bee Car	ves Road, Austin, TX
				oicnization detection v	
		remperature: 2			
		COLLECTION MED			
		COLLECTION SYS			
				used. /Detector Tempera	
<b>.</b>	רווום	ENGE CHEMICAL	. 1	: COMPONENT 2	3
	1. 1	THEM NAME(s):	Allyl Chloride	: 'N/A	; ; \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
		CAS NUMBER(s):		N/A	N/A
		CONC. (IF MIX)		N/A	N/A
	4. (	CHEMICAL SOURCE	E:Aldrich	: N/A	N/A
•	2. NU 3. BI	MBER OF SAMPL REAKTHROUGH TI	1-28-87 ES TESTED: One (Run ME: 203 minutes	III)	
•	2. NU 3. BI 4. MI 5. SI 6. SA	ATE TESTED:  JMBER OF SAMPL  REAKTHROUGH TI  IN DETECTABLE  FEADY STATE PE  LMPLE THICKNES	ES TESTED: One (Run  ME: 203 minutes  LIMIT .03 ppm  RMEATION RATE .15 ( S: 19-20 mil	ug/cm <sup>2</sup> *hr)	
•	2. NU 3. BI 4. MI 5. SI 6. SA	ATE TESTED: JMBER OF SAMPL REAKTHROUGH TI IN DETECTABLE FEADY STATE PE	ES TESTED: One (Run  ME: 203 minutes  LIMIT .03 ppm  RMEATION RATE .15 ( S: 19-20 mil	ug/cm <sup>2</sup> *hr)	: JONCENTRATION
-	2. NU 3. BI 4. MI 5. SI 6. SA 7. SI	TIME	LES TESTED: One (Run IME: 203 minutes  LIMIT03 ppm  ERMEATION RATE .15 ( S: 19-20 mil POINTS N/A	ug/cm <sup>2</sup> *hr)	ONCENTRATION
	2. NU 3. BI 4. MI 5. SI 6. SA 7. SI	TIME	LES TESTED: One (Run IME: 203 minutes  LIMIT03 ppm  ERMEATION RATE .15 ( S: 19-20 mil POINTS N/A	ug/cm <sup>2</sup> *hr)	ONCENTRATION
	2. NU 3. BF 4. MI 5. SI 7. SI	TE TESTED:  OMBER OF SAMPL  REAKTHROUGH TI  IN DETECTABLE  TEADY STATE PE  AMPLE THICKNES  ELECTED DATA P  TIME	LES TESTED: One (Run IME: 203 minutes  LIMIT03 ppm  ERMEATION RATE .15 ( S: 19-20 mil POINTS N/A	ug/cm <sup>2</sup> *hr)	CONCENTRATION
	2. NU 3. BI 4. MI 5. SI 6. SA 7. SI	TIME	LES TESTED: One (Run IME: 203 minutes  LIMIT03 ppm  ERMEATION RATE .15 ( S: 19-20 mil POINTS N/A	ug/cm <sup>2</sup> *hr)	CONCENTRATION
	2. NU 3. BI 4. MI 5. SI 7. SI 1. 2. 3. 4.	ATE TESTED:  MBER OF SAMPL REAKTHROUGH TI IN DETECTABLE TEADY STATE PE AMPLE THICKNES ELECTED DATA P  TIME	LES TESTED: One (Run IME: 203 minutes  LIMIT03 ppm  ERMEATION RATE .15 ( S: 19-20 mil POINTS N/A	ug/cm <sup>2</sup> *hr)	JONCENTRATION
	2. NU 3. BI 4. MI 5. SI 7. SI 1. 2. 3. 4.	ATE TESTED: UMBER OF SAMPL REAKTHROUGH TI IN DETECTABLE FEADY STATE PE AMPLE THICKNES ELECTED DATA P  TIME	LES TESTED: One (Run IME: 203 minutes  LIMIT03 ppm  ERMEATION RATE .15 ( S: 19-20 mil POINTS N/A	ug/cm <sup>2</sup> *hr)  : CONCENTRATION : :	
	2. NU 3. BI 4. MI 5. SI 7. SI 1. 2. 3. 4. 5.	ATE TESTED: UMBER OF SAMPL REAKTHROUGH TI IN DETECTABLE TEADY STATE PE AMPLE THICKNES ELECTED DATA P  TIME	LES TESTED: One (Run IME: 203 minutes  LIMIT03 ppm  ERMEATION RATE .15 ( S: 19-20 mil POINTS N/A	ug/cm <sup>2</sup> *hr)  : CONCENTRATION : :	JONCENTRATION
	2. NU 3. BI 4. MI 5. SI 6. SA 7. SI 1. 2. 3. 4. 5.	ATE TESTED:  OMBER OF SAMPL  REAKTHROUGH TI  IN DETECTABLE  TEADY STATE PE  AMPLE THICKNES  ELECTED DATA P  TIME	LES TESTED: One (Run IME: 203 minutes  LIMIT03 ppm  ERMEATION RATE .15 ( S: 19-20 mil POINTS N/A	ug/cm <sup>2</sup> *hr)  : CONCENTRATION : :	
	2. NU 3. BI 4. MI 5. SI 7. SI 1. 2. 3. 4. 5.	ATE TESTED:  OMBER OF SAMPL  REAKTHROUGH TI  IN DETECTABLE  TEADY STATE PE  AMPLE THICKNES  ELECTED DATA P  TIME	LES TESTED: One (Run IME: 203 minutes  LIMIT03 ppm  ERMEATION RATE .15 ( S: 19-20 mil POINTS N/A	ug/cm <sup>2</sup> *hr)  : CONCENTRATION : :	
	2. NU 3. BI 4. MI 5. SI 6. SA 7. SI 1. 2. 3. 4. 5. 6. 7.	ATE TESTED:  OMBER OF SAMPL  REAKTHROUGH TI  IN DETECTABLE  TEADY STATE PE  AMPLE THICKNES  ELECTED DATA P  TIME	LES TESTED: One (Run IME: 203 minutes  LIMIT03 ppm  RMEATION RATE15 ( SS: 19-20 mil POINTS N/A  : CONCENTRATION : : : : : : : :	ug/cm <sup>2</sup> *hr)  : CONCENTRATION : :	
	2. NU 3. BI 4. MI 5. SI 6. SA 7. SI 1. 2. 3. 4. 5. 6. 7. 8. 9.	THE OBSERVATI	LES TESTED: One (Run IME: 203 minutes  LIMIT03 ppm  RMEATION RATE15 ( SS: 19-20 mil POINTS N/A  : CONCENTRATION : : : : : : : :	ug/cm <sup>2</sup> *hr)  : CONCENTRATION : :	
	2. NU 3. BI 4. MI 5. SI 6. SA 7. SI 1. 2. 3. 4. 5. 6. 7. 8. 9.	TIME  TIME  TIME  THER OBSERVATI	ES TESTED: One (Run  IME: 203 minutes  LIMIT .03 ppm  RMEATION RATE .15 ( IS: 19-20 mil  POINTS N/A  : CONCENTRATION : : : : : : : : : : : : : : : : : : :	concentration  concentration  concentration  concentration	
-	2. NU 3. BI 4. MI 5. SI 6. SA 7. SI 1. 2. 3. 4. 5. 6. 7. 8. 9.	TIME  TIME  TIME  THER OBSERVATI	ES TESTED: One (Run  IME: 203 minutes  LIMIT .03 ppm  RMEATION RATE .15 ( IS: 19-20 mil  POINTS N/A  : CONCENTRATION : : : : : : : : : : : : : : : : : : :	ug/cm <sup>2</sup> *hr)  : CONCENTRATION : :	

## Chemical Resistance Testing of Challenge 5 100 Material

Ally! Chloride Run #

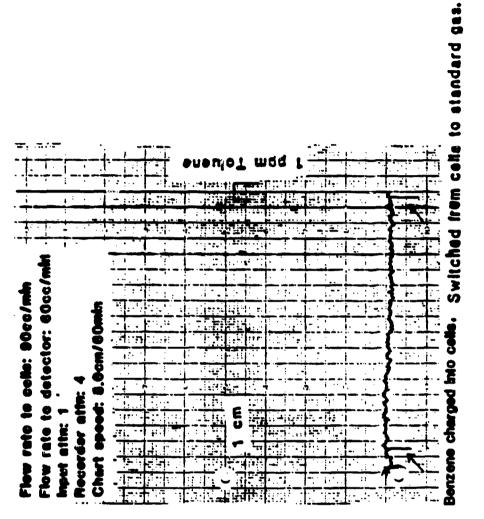


	1: TY	PE: Teflon la	minated Nomex		•
			RIAL CODE: 068		
	3: CO	NDITION BEFOR	E TEST: Unused, no vi	sible imperfections	
	4: MA	NUFACTURER:	Chemfab Corp.		
	5: PR	ODUCT IDENTIF	ICATION: Challenge 51	00	
	6: L0	T OR MANUFACT	URER DATE: N/A		
			SS: 15-20 mil		
	8: DE	SCRIPTION: _M	laterial was buff color	ed.	
·	TEST M	ETHOD			
	1. TE	STING LABORAT	ORY: Texas Research In	stitute. 9063 Bee Cay	es Road Austin T
	2. AN	ALYTICAL METH	OD: Continuous photoi	onization detection w	oth a 11.70 eV lam
	3 TE	MPERATURE: 22	-25°C		77077 2 22770 27 123
		LLECTION MEDI			<del></del>
	5. CO	LLECTION SYST	EM: No		
	6. OT	HER CONDITION	S: 2 inch cells were	used. /Detector Temp	erature = 60C.
	7. DE	VIATIONS FROM	ASTM F739 METHOD: Flo	w rate to cells was 9	C cc/min.
•	CHALLE	NEE CHEMICAL	1 :	COMPONENT 2 :	3
		EM NAME(s):		N/A	N/A
		S NUMBER(s):		N/A	N/A
	3. CO	NC. (IF MIX)	N/A:	N/A :	N/A
	4. CH	ENICAL SOURCE	:J.T. Baker reagent :	N/A :	N/A
			grade :	N/A :	N/A
•	TEST R	ESULTS			
•	1. DAT 2. NUM 3. BRE 1. MIN	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L	oril 14, 1986 S TESTED: Three E: No breakthrough wa IMIT 0.46 ppm		
•	1. DAT 2. NUM 3. BRE 4. MIN 5. STE	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER	oril 14, 1986 S TESTED: Three E: No breakthrough wa IMIT 0.46 ppm MEATION RATE E/A		
•	1. DAT 2. NUM 3. BRE 1. MIN 5. STE 6. SAM	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L	STESTED: Three E: No breakthrough wa IMIT 0.46 ppm MEATION RATE P:/A : 17-19 mil		
•	1. DAT 2. NUM 3. BRE 1. MIN 5. STE 6. SAM	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER PLE THICKNESS	STESTED: Three E: No breakthrough wa IMIT 0.46 ppm MEATION RATE P:/A : 17-19 mil		hours.
•	1. DAT 2. NUM 3. BRE 1. MIN 5. STE 6. SAM 7. SEL	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER PLE THICKNESS ECTED DATA PO	oril 14, 1986 S TESTED: Three E: No breakthrough wa IMIT 0.46 ppm MEATION RATE N/A : 17-19 mil INTS N/A	s observed after 3.25	hours.
•	1. DAT 2. NUM 3. BRE 1. MIN 5. STE 6. SAM 7. SEL	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER PLE THICKNESS ECTED DATA PO	oril 14, 1986 S TESTED: Three E: No breakthrough wa IMIT 0.46 ppm MEATION RATE N/A : 17-19 mil INTS N/A	s observed after 3.25	hours.
•	1. DAT 2. NUM 3. BRE 1. MIN 5. STE 6. SAM 7. SEL	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER PLE THICKNESS ECTED DATA PO	oril 14, 1986 S TESTED: Three E: No breakthrough wa IMIT 0.46 ppm MEATION RATE N/A : 17-19 mil INTS N/A	s observed after 3.25	hours.
•	1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM 7. SEL 1.	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER PLE THICKNESS ECTED DATA PO	oril 14, 1986 S TESTED: Three E: No breakthrough wa IMIT 0.46 ppm MEATION RATE N/A : 17-19 mil INTS N/A	s observed after 3.25	hours.
•	1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM 7. SEL 1. 2. 3.	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER PLE THICKNESS ECTED DATA PO	oril 14, 1986 S TESTED: Three E: No breakthrough wa IMIT 0.46 ppm MEATION RATE N/A : 17-19 mil INTS N/A	s observed after 3.25	hours.
	1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM 7. SEL 1. 2. 3. 4.	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER PLE THICKNESS ECTED DATA PO	oril 14, 1986 S TESTED: Three E: No breakthrough wa IMIT 0.46 ppm MEATION RATE N/A : 17-19 mil INTS N/A	s observed after 3.25	hours.
	1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM 7. SEL 1. 2. 3. 4.	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER PLE THICKNESS ECTED DATA PO	oril 14, 1986 S TESTED: Three E: No breakthrough wa IMIT 0.46 ppm MEATION RATE N/A : 17-19 mil INTS N/A	s observed after 3.25	hours.
	1. DAT 2. NUM 3. BRE 1. MIN 5. STE 6. SAM 7. SEL 1. 2. 3. 4. 5.	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER PLE THICKNESS ECTED DATA PO	oril 14, 1986 S TESTED: Three E: No breakthrough wa IMIT 0.46 ppm MEATION RATE N/A : 17-19 mil INTS N/A	s observed after 3.25	hours.
•	1. DAT 2. NUM 3. BRE 1. MIN 5. STE 6. SAM 7. SEL 1. 2. 3. 4. 5.	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER PLE THICKNESS ECTED DATA PO TIME	oril 14, 1986 S TESTED: Three E: No breakthrough wa IMIT 0.46 ppm MEATION RATE N/A : 17-19 mil INTS N/A	s observed after 3.25	hours.
	1. DAT 2. NUM 3. BRE 1. MIN 5. STE 6. SAM 7. SEL 1. 2. 3. 4. 5. 6. 7. 8.	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER PLE THICKNESS ECTED DATA PO TIME	oril 14, 1986  S TESTED: Three  E: No breakthrough wa IMIT 0.46 ppm  MEATION RATE P:/A : 17-19 mil INTS N/A  : CONCENTRATION : : : : : : : :	s observed after 3.25  CONCENTRATION	hours.
	1. DAT 2. NUM 3. BRE 1. MIN 5. STE 6. SAM 7. SEL 1. 2. 3. 4. 5. 6. 7. 8.	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER PLE THICKNESS ECTED DATA PO TIME	oril 14, 1986 S TESTED: Three E: No breakthrough wa IMIT 0.46 ppm MEATION RATE E/A : 17-19 mil INTS N/A  : CONCENTRATION : : : : : :	s observed after 3.25  CONCENTRATION	hours.
	1. DAT 2. NUM 3. BRE 1. MIN 5. STE 6. SAM 7. SEL 1. 2. 3. 4. 5. 6. 7. 8.	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER PLE THICKNESS ECTED DATA PO TIME	oril 14, 1986  S TESTED: Three  E: No breakthrough wa IMIT 0.46 ppm  MEATION RATE P:/A : 17-19 mil INTS N/A  : CONCENTRATION : : : : : : : :	s observed after 3.25  CONCENTRATION	hours.
	1. DAT 2. NUM 3. BRE 1. MIN 5. STE 6. SAM 7. SEL 1. 2. 3. 4. 5. 6. 7. 8. 9.	E TESTED: Ap BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER PLE THICKNESS ECTED DATA PO TIME	oril 14, 1986  S TESTED: Three  E: No breakthrough wa IMIT 0.46 ppm  MEATION RATE P:/A : 17-19 mil INTS N/A  : CONCENTRATION : : : : : : : :	s observed after 3.25  CONCENTRATION	hours.

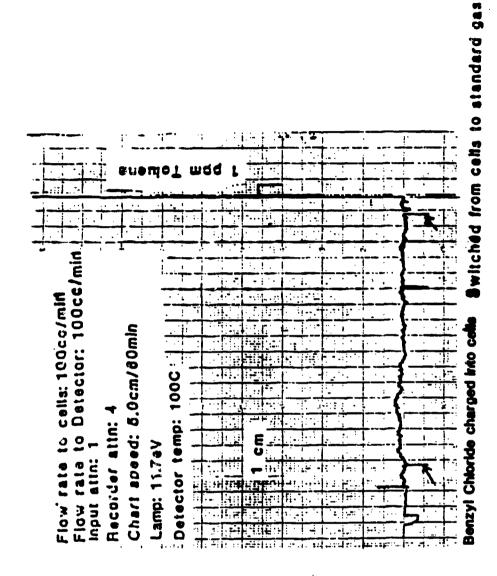
		C	906	90cc/mh	<b>.</b>	<b>.</b>	_ -		Ì	- <del></del>	;	+		•		;	<del></del>		<u> </u>
Flow	rate to	detector: 60cc/min	stor:	<b>6</b> 0c	ή <b>ш/</b> ο	  -	_				<u> </u>	- 1					<u></u>		$\dashv$
	er attn:	4						•		·									
Chart	:peeds		6.0cm/80min	T L		•	<u> </u> _	!		<u>:</u>	<u> </u>	!	<u> </u>	!	1		<u>-</u>	<del> </del>	<del>                                     </del>
		-j-	+	-		<u>.                                    </u>	-	• [	1.	1	1	!	1-	<u> </u>		-	-	i.	<del></del>
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1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imparfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was buff colored.
2.	TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road. Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp. 3. TEMPERATURE: 22-25 C 4. COLLECTION MEDIUM: No 5. COLLECTION SYSTEM: No 6. OTHER CONDITIONS: 2 inch cells were used. /Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 90cc/min
3.	CHALLENGE CHEMICAL I : COMPONENT 2 : 3
	1. CHEM NAME(s): Benzene : N/A : N/A 2. CAS NUMBER(s): 71-43-2 : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 4. CHEMICAL SOURCE: Fisher reagent grade: N/A : N/A
4.	TEST RESULTS
	1. DATE TESTED: April 9, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3.2 hours 4. MIN DETECTABLE LIMIT .05 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1
	2. 3. : : : : : : : : : : : : : : : : : : :
	4. : : : : : : : : : : : : : : : : : : :
	5. : : : : : : : : : : : : : : : : : : :
	7. : : : : : : : : : : : : : : : : : : :
	8
	10.
	8. OTHER OBSERVATIONS:
5.	SOURCE OF DATA Samples were run by Karen Verschoor on April 9, 1986

## Chemical Resistance Testing of USCG Material with Benzene

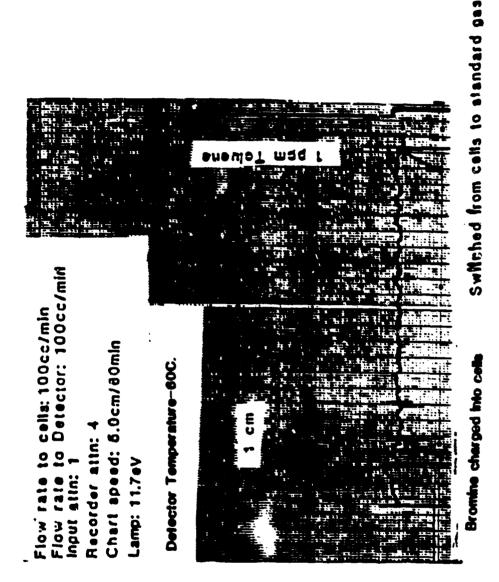


• •	DESCRIPTION OF PRODUCT EVALUATED		
	1: TYPE: Teflon laminated Nomex		
	2: PROTECTIVE MATERIAL CODE: 068		
	3: CUNDITION BEFORE TEST: Unused, no	visible imperfection	5
	4: MANUFACTURER: Chemfab Corp.		
	5: PRODUCT IDENTIFICATION: Challenge	5100	
	6: LOT OR MANUFACTURER DATE: N/A		
	7: NOMINAL THICKNESS: 15-20 mil		
	8: DESCRIPTION: Material was buff cold	oreu.	
2.	TEST METHOD		
	1. TESTING LABORATORY: Texas Research	institute, 9063 Bee	Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous prote	pionization detectio	n with a 11.70 eV lamp.
	3. TEMPERATURE: 22-25°C		
	4. COLLECTION MEDIUM: N2		
	6. OTHER CONDITIONS: 2 inch cells we	no used /Detector Te	700
	7. DEVIATIONS FROM ASTM F739 METHOD:	flow rate to cells w	as 90cc/min.
3.	CHALLENGE CHEMICAL 1	: COMPONENT 2	3
	1. CHEM MANE(s): Benzyl Chloride	: N/A	: N/A
	2. CAS NUMBER(s): 100-44-7	: N/A	N/A
	3. CONC. (IF MIX) N/A	: N/A	: N/A
	4. CHEMICAL SOURCE: Alarich reagent	: N/A	: N/A
	grade	: <u>N/A</u>	:N/A
4.	TEST RESULTS		
	1. DATE TESTED: April 10, 1986		
	2. NUMBER OF SAMPLES TESTED: Three		
	3. BREAKTHROUGH TIME: No breakthrough	was observed after	3.2 hours.
	4. MIN DETECTABLE LIMIT 0.11 ppm		
	5. STEADY STATE PERMEATION RATE N/A		
	6. SAMPLE THICKNESS: 17-19 mil		
	7. SELECTED DATA POINTS N/A		<del></del>
	TIME : CONCENTRATION :	: CONCENTRATION	: CONCENTRATION
	2.	•	
	3.		<del></del>
	4. 5.		•
	6.	<del></del>	<del></del>
	<i>i</i>	<del></del>	:
	8.	<u> </u>	
	9.	:	•
	10		:
	8. OTHER OBSERVATIONS:		
5.	SOURCE OF DATA		
	Samples were run by Karen Versc	<u>noor on April 10, 19</u>	18b.



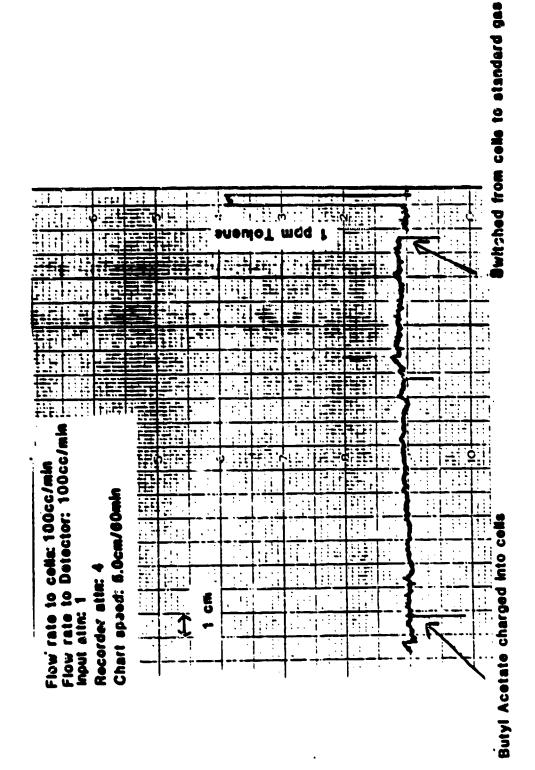
1.	DESCRIPTION OF PRODUCT EV	ALUATED			
	1: TYPE: Teflon laminate 2: PROTECTIVE MAYERIAL ( 3: CONDITION BEFORE TEST 4: MANUFACTURER: Chemfort 5: PRODUCT IDENTIFICATIO 6: LOT OR MANUFACTURER ( 7: NOMINAL THICKNESS: 1 8: DESCRIPTION: Materia	CODE: 068 T: Unused, no vis ab Corp. DN: Challenge 510 DATE: N/A	0		lored on the
2.	TEST METHOD		•		
	1. TESTING LABORATORY: 1 2. ANALYTICAL METHOD: 0 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: 1 5. COLLECTION SYSTEM: 1 6. OTHER CONDITIONS: 1 7. DEVIATIONS FROM ASTM	Continuous photoic  12 12 13 14 15 16 17 16 17 17 18 18 18 18 18 18 18 18 18 18 18 18 18	nization detection used. /Detector T	on with a l	1.70 eV lamp.
3.	CHALLENGE CHEMICAL	1 :	COMPONENT 2	:	3
	1. CHEN NAME(s): Brom	ine :	N/A	:	N/A
	2. CAS NUMBER(s): 7726-		N/A	_:	N/A
	3. CONC. (IF MIX) N/A		N/A	_:	N/A
	4. CHEMICAL SOURCE: ATdr	ch reagent :	N/A		N/A
	EST RESULTS		N/A		N/A
	1. DATE TESTED: September 2. NUMBER OF SAMPLES TESTS 3. BREAKTHROUGH TIME: NO 4. MIN DETECTABLE LIMIT 5. STEADY STATE PERMEATT 6. SAMPLE THICKNESS: 19-27. SELECTED DATA POINTS	ED: Three b breakthrough was .53 ppm DN RATE N/A 20 mil	observed after 3	.26 hours.	
	TIME :	CONCENTRATION	: CONCENTRATION	: CONC	ENTRATION
	2. 3.			<u> </u>	
	4.			<u>:</u>	
	5 <u>:</u>				
	6. :			<u>:</u>	
	7. :		<u>:</u>		
	8	<del></del>	<del>!</del>	_ <del></del> -	
	10.		•	<u> </u>	
			·		
	8. OTHER OBSERVATIONS:				
5.	SOURCE OF DATA Samples were run	by Karen Verschoom	on September 4,	1986.	

## Chemical Resistance Testing of USCG Material with Bromine

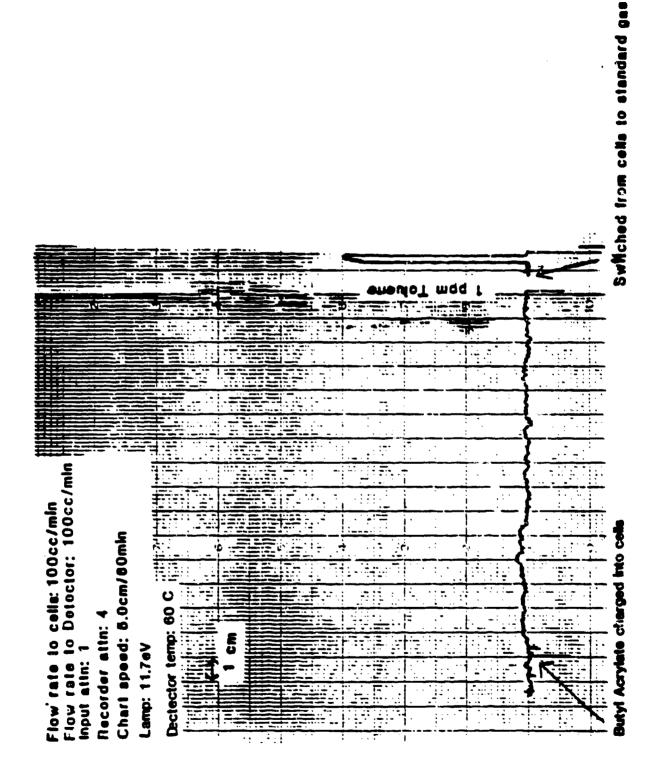


C-63

1,	DESCRIPTION OF PRODU	JCT EVALUATED							
	1: TYPE: Teflon lar	ninated Nomex							
	2: PROTECTIVE MATER		<del></del>						
		TEST: Unused, no vis	ible imperfections						
	4: MANUFACTURER: _C	hemfab Corp.							
		CATION: Challenge 510	0						
	6: LOT OR MANUFACTU								
	7: NOMINAL THICKNES								
	8: DESCRIPTION: Ma other side.	aterial was orange cold	red on one side and	butt colored on the					
2.	TEST METHOD								
	1. TESTING LABORATO	RY: Texas Research Ins	titute. 9063 Bee Cav	es Road. Austin. TX					
	2. ANALYTICAL METHO	D: Continuous photoio	nization detection w	th a 11.7 eV lamp.					
	3. TEMPERATURE: 22-	25 °C							
	4. COLLECTION MEDIL								
	5. COLLECTION SYSTE								
		: linch cells were u							
	7. DEVIATIONS FROM	7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min.							
3.	CHALLENGE CHEMICAL	1 :	COMPONENT 2 :	3					
	1. DHEM NAME (s) :	Butyl Acetate :	N/A :	N/A					
	2. CAS NUMBER(s):	540-88-5	N/A :	N/A					
	3. CONC. (IF MIX)	N/A	N/A :	N/A					
	4. CHEMICAL SOURCE:	J.T. Baker reagent :	N/A:	N/A					
	TEST RESULTS	grade :	N/A	N/A					
	1. DATE TESTED: JU 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERI 6. SAMPLE THICKNESS: 7. SELECTED DATA PO	TESTED: Three : No breakthrough was IMIT 0.25 ppm MEATION RATE N/A : 18-19 mil	observed after 3 ho	urs.					
	TIME :	CONCENTRATION	: CONCENTRATION :	CONCENTRATION					
	2.		:						
	3.		<u>:                                    </u>						
	4.		<u>:                                    </u>						
	5. 6.		<del>:</del>						
	7.		<u> </u>						
	8.		<u> </u>						
	9.		<u>·                                      </u>						
	10,		<del></del>						
	· · · · · · · · · · · · · · · · · · ·								
	8. OTHER OBSERVATION	NS:							
e	-			· <del></del>					
э.	SOURCE OF DATA Samples were	e run by Sylvia Cooper	on July 7, 1986.						



DESCRIPTION OF PRODUCT EVALUATED							
1: TYPE: Teflon laminated Nomex							
2: PROTECTIVE MATERIAL CODE: 068							
3: CONDITION BEFORE TEST: Unused, no v	isible imperfections						
4: MANUFACTURER: Chemfab Corp.							
5: PRODUCT IDENTIFICATION: Challenge 5	100						
6: LOT OR MANUFACTURER DATE: N/A							
7: NOMINAL THICKNESS: 15-20 mil							
8: DESCRIPTION: Mathrial was orange co	lored on one side and	buff colored on the					
other side.							
TEST METHOD							
	AA/8 A =	<del></del>					
1. TESTING LABORATORY: Texas Research I							
2. ANALYTICAL METHOD: Continuous photo	ionization detection	with a 11.70 eV lamp.					
3. TEMPERATURE: 22-25°C							
4. COLLECTION MEDIUM: N2							
5. COLLECTION SYSTEM: N2							
6. OTHER CONDITIONS: 1 inch cells wer							
7. DEVIATIONS FROM ASTM F/39 METHOD: Flow rate to cells was 100 cc/min.							
CRALLENGE CHEMICAL 1	: COMPONENT 2	: 3					
1. CHEM MANE(s): Buryl Acrylate	: N/A	: N/A					
2. CAS NUMBER(s): 141-32-2	: N/A	N/A					
3. CONC. (IF MIX) N/A	: N/A	N/A					
4. CHEMICAL SOURCE: Aldrich reagent	N/A	N/A					
grade	N/A	N/A					
TEST RESULTS		··					
1. DATE TESTED: July 21, 1986							
2. NUMBER OF SAMPLES TESTED: Three							
3. BREAKTHROUGH TIME: No breakthrough wa	s observed after 3 ho	urs.					
4. MIN DETECTABLE LIMIT 0.22 ppm							
5. STEADY STATE PERMEATION RATE N/A							
6. SAMPLE THICKNESS: 13-19 mil	<del></del>						
7. SELECTED DATA POINTS N/A							
TIME . : CONCENTRATION	: CONCENTRATION	: CONCINTRATION					
2:		:					
3. ————————————————————————————————————	<del></del>	<u>:</u>					
4.		:					
5.		<u> </u>					
6.		:					
7.	1	:					
8. :	· · · · · · · · · · · · · · · · · · ·	:					
9.	•	:					
10, :	:	:					
8. OTHER OBSERVATIONS:							
SOURCE OF DATA							
Samples were run by Sylvia Cooper	on July 21, 1986						



2:	TYPE: Teflon laminated Nomex PROTECTIVE MATERIAL CODE: 068		
3:		vicible imperfection	
) :   :		VISIDIE IEPETIECTION	
5 :		3100	<del></del>
:			
<b>B</b> :	DESCRIPTION: Material was buff co	lored.	
TES	ST METHOD		
<b>1</b> .	TESTING LABORATORY: Texas Research	Institute, 9063 Bee	Caves Road, Austin, 1
2.	ANALYTICAL METHOD: Continuous phot	olonization detection	with a 11.70 eV les
	TEMPERATURE: 22-25°C		·
	COLLECTION MEDIUM: N2		
-			
, .	OTHER CONDITIONS: 2 inch cells we DEVIATIONS FROM ASZM F739 METS D:	It used /Detector Ter	perature =60C
		Flow late to cells of	2000072111.
<b></b> .	LIENCE CHEMICAL 1	: CONFORMET 2	: <b>3</b>
١.	CHEM NAME(s): B-Butyl elcohol	: T/A	: 7/A
	CAS NUMBER(s): 71-36-3	: N/A	N/A
		31/4	- <u> </u>
₽•	CONC. (IF MIX) N/A	: N/A	: N/A
4. Teb	CREMICAL SOURCE: Baker reagent grade T RESULTS		N/A N/A
1 . 1 . 2 . 3 . 4 . 5 .	CREMICAL SOURCE: Baker reagent grade  T RESULTS  DATE TESTED: May 16, 1986  NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: Mo breakthrough MIN DETECTABLE LIMIT .32 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE TRICKNESS: 17-19 mil.	: N/A	: N/A
123 1. 2. 3. 4. 5.	CREMICAL SOURCE: Baker reagent grade T RESULTS  DATE TESTED: May 16, 1986 NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .32 ppm STEADY STATE PERMEATION RATE N/A	: N/A	: N/A
1 . 2 . 3 . 5 .	CREMICAL SOURCE: Baker Feagent grade  T RESULTS  DATE TESTED: May 16, 1986  NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .32 ppm  STEADY STATE PERMEATION BATE N/A  SAMPLE TRICKNESS: 17-19 mil.  SELECTED DATA POINTS N/A  TIME : CONCENTRATION	N/A  vas observed after 1	: N/A 5.6 hours.
1	CREMICAL SOURCE: Baker Feagent grade  T RESULTS  DATE TESTED: May 16, 1986  NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .32 ppm  STEADY STATE PERMEATION BATE N/A  SAMPLE TRICKNESS: 17-19 mil.  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1.	N/A  vas observed after 1	: N/A 5.6 hours.
1	CREMICAL SOURCE: Baker Feagent grade  T RESULTS  DATE TESTED: May 16, 1986  NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .32 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE TRICKNESS: 17-19 mil.  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. :	N/A  vas observed after 1	: N/A 5.6 hours.
183	CREMICAL SOURCE: Baker Feagent grade  T RESULTS  DATE TESTED: May 16, 1986  NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: Mo breakthrough MIN DETECTABLE LIMIT .32 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 17-19 mil.  SELECTED DATA POINTS N/A  TIME: CONCENTRATION  1	N/A  vas observed after 1	: N/A 5.6 hours.
1 : 2 : 3 : 4 : 4 : 5 : 5 : 5 : 5 : 5 : 5 : 5 : 5	CREMICAL SOURCE: Baker reagent grade  T RESULTS  DATE TESTED: May 16, 1986  NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: Mo breakthrough MIN DETECTABLE LIMIT .32 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE TRICKNESS: 17-19 mil.  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1	N/A  vas observed after 1	: N/A 5.6 hours.
1 : 2 : 3 : 4 : 4 : 5 : 5 : 5 : 5 : 5 : 5 : 5 : 5	CREMICAL SOURCE: Baker Feagent grade  T RESULTS  DATE TESTED: May 16, 1986  NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: Mo breakthrough MIN DETECTABLE LIMIT .32 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE TRICKNESS: 17-19 mil.  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. :	N/A  vas observed after 1	: N/A 5.6 hours.
183	CREMICAL SOURCE: Baker reagent grade  T RESULTS  DATE TESTED: May 16, 1986  NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: Mo breakthrough MIN DETECTABLE LIMIT .32 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE TRICKNESS: 17-19 mil.  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1	N/A  vas observed after 1	: N/A 5.6 hours.
183	CREMICAL SOURCE: Baker Feagent grade  T RESULTS  DATE TESTED: May 16, 1986  NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: Mo breakthrough MIN DETECTABLE LIMIT .32 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE TRICKNESS: 17-19 mil.  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3	N/A  vas observed after 1	: N/A 5.6 hours.
1 · · · · · · · · · · · · · · · · · · ·	CREMICAL SOURCE: Baker Feagent grade  T RESULTS  DATE TESTED: May 16, 1986  NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .32 ppm  STEADY STATE PERMEATION BATE N/A  SAMPLE TRICKNESS: 17-19 mil.  SELECTED DATA POINTS N/A  TIME: CONCENTRATION  1. 2. 3. 4. 5. 6. :	N/A  vas observed after 1	: N/A 5.6 hours.
1	CREMICAL SOURCE: Baker Feagent grade  T RESULTS  DATE TESTED: May 16, 1986  NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .32 ppm  STEADY STATE PERMEATION BATE N/A  SAMPLE TRICKNESS: 17-19 mil.  SELECTED DATA POINTS N/A  TIME: CONCENTRATION  1. 2. 3. 4. 5. 6. 7. 8.	N/A  vas observed after 1	: N/A 5.6 hours.
4. 123 1. 2. 3. 4. 5.	CREMICAL SOURCE: Baker Feagent grade  T RESULTS  DATE TESTED: May 16, 1986  NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: Mo breakthrough MIN DETECTABLE LIMIT .32 ppm STEADY STATE PERMEATION RATE N/A SAMPLE TRICKNESS: 17-19 mil.  SELECTED DATA POINTS N/A  TIME: CONCENTRATION  1	N/A  vas observed after 1	: N/A 5.6 hours.
1. 2. 3. 4. 5.	CREMICAL SOURCE: Baker Feagent grade  T RESULTS  DATE TESTED: May 16, 1986  NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .32 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE TRICKNESS: 17-19 mil.  SELECTED DATA POINTS N/A  TIME: CONCENTRATION  1. 2. 3. 4. 5. 6. 7. 8. 9.	N/A  vas observed after 1	: N/A 5.6 hours.

# Chemical Resistance Testing of USCG Material with n-Butyl Alcohol

<u>productions are the second and the second are second as the second are second are second as the second are second are second as the second are second as the second are</u>

Flow rate to Detector: 100cc/min Flow rate to cells: 100cc/min Chart speed: 5.0cm/60min Recorder attn: 4 Input attn: 1

n-Butyl Alcohol charged into cells

Switched from cells to standard gas

_			CAL PROTECTIVE CI			. <del></del>	
1.		RIPTION OF PROD					
		TYPE: Teflon la			<del></del>		
			RE TEST: Unused,	no visible imper	fections		_
		ANUFACTURER:					
			ICATION: Challen	ge 5100			_
	-	LOT OR MANUFACT IOMINAL THICKNE			<del></del>		-
				e colored on one	side and bu	ff colored on the	
	-	other side.					_
<b>?</b> .	TEST	METHOD				•	
	2. 7	resting Laborat Lnalytical meth	ORI: Texas Resear	chotoionization	etection wit	Road, Austin, TX h a 11.70 eV lamp.	
	3. 1	TEMPERATURE: 22	-25°C				<del></del>
	4. (	OLLECTION MEDI					<b>-</b>
		POLLECTION SIST FIELD CONDITION					_
			ASTM F739 METHOD	s were used/Dete	cells was 10	Cure = 5UC. Occ/min.	-
			•				
<b>3</b> -		ENE THEFTICAL	1	: COMPONE		3	
		men name(6):		: #/A		N/A	_
		CAS NUMBER(s): CONC. (IF MIX):		: N/A : N/A		N/A N/A	
	4.	MEMICAL SOURCE	:Aldrich reagent	: N/A		N/A	
			grade	: N/A		N/A	
4.	TEST	RESULTS					
	1. 0/	TE TESTED: No	ıy 19, 1986				
	2. N	MBER OF SAMPLE				<del></del>	•
			E: No breakthrou	gh was observed	after 3 hour	3.	_
		IN DETECTABLE L					
		MPLE THICKNESS	CHEATION RATE N/A	<u> </u>			
		ELECTED DATA PO				· · · · · · · · · · · · · · · · · · ·	_
		40 T					
	1.	TIME	: Concentrat	ION : CONCER	TRATION:	CONCENTRATION	
	2		<u>:</u>	<u>-</u>	<del></del>		<del></del>
	3.		:				_
	4.		:				
	5. 6.		:			يد مسيحه النواقة، بدالة الكالمسيد،	
	7.		:	-			
	8		:	:	:		
	9.		:				
	10		•	<u>:</u>	•		_
	8. 0	THER OBSERVATION	OHS:				
5.	SOITE	CE OF DATA					
	SOURI		run by Sylvia C	ooper May 19, 19	86		

## Chemical Resistance Testing of USCG Material with Butyl Amine

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Butyl Amine charged into cells

Switched front cells to standard gas

1:	TYPE: Teflon 1	aminated Nomex		
2:		ERIAL CODE: 068		
3:		RE TEST: Unused, no	visible imperfection	ns
4:		Chemfab Corp.		
5:		FICATION: Challenge	5100	
6:		TURER DATE: N/A		
7:		ESS: 15-20 mil		
8:	DESCRIPTION:	Material was orange	colored on one side	and buff colored on t
	other side.			
TES	T METHOD			
1.	TESTING LABORA	TORY: Tayes Research	Institute 9063 Res	Caves Road, Austin,
2.				on with a 10.20 eV la
2. 3.	•		COLUMNIZACION GEORGE	011 01111 1 10.120 11 24
	COLLECTION MEI			
	COLLECTION SYS			
		ONS: 1 inch cells w	ere used. /Detector T	emperature el 00C.
7.	DEVIATIONS FRO	M ASTM F739 METHOD:	Flow rate to cells	was 200 cc/min.
•			1 204 1860 10 00113	
CHA	LLENGE CHEMICAL	. 1	: Component 2	: 3
1-	CHEM NAME (s)	Butyraldehyde	: N/A	: N/A
2.	CAS NUMBER(s)	123-72-8	: N/A	: N/A
	CONC. (IF MIX)		: N/A	· N/A
4.	CHEMICAL SOUR	E:Aldrich reagent	: N/A	: N/A
		grade	: N/A	. N/A
1.	T RESULTS  DATE TESTED: Ju			
		ES TESTED: Three		
3.	BREAKTHROUGH T	ME: No breakthrough	was observed after	7.5 hours.
4.	MIN DETECTABLE	LIMIT .29 pom		
		ERMEATION RATE N/A		
	SAMPLE THICKNES			
7.	SELECTED DATA	POINTS N/A		
	TIME	: CONCENTRATIO	n : CONCENTRATIO	ON : CONCENTRATION :
	2.	:		. \$
	3.	_ <b>:</b>	:	
	4.	<u>:</u>	;	
	5.	<u>:</u>	<u> </u>	
	6	:	<u> </u>	
	7.	:	:	
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		rove -		
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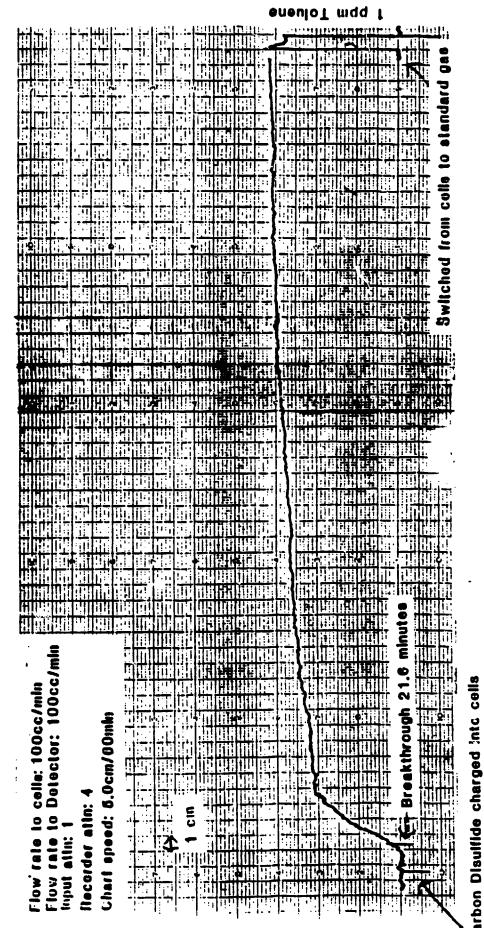
# Chemical Resistance Testing of USCG Material with Butyraldehyde

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Flow rate to cells: 100cc/min Flow rate to Dectector: 100cc	. Input attrc 10	ž	Lamp: 10.2eV	ě	Dectector temp: 10	<del>-11</del>					1	111	F	17.00	Ť			-	Κ,

*•	DESCRIPTION OF PROL	OCT ETALONIES		
	1: TYPE: Teflon la	aminated Nome		,
	2: PROTECTIVE MATE	RIAL CODE: 068		
	3: CONDITION BEFOR	RE TEST: Unused, no v	isible importantion	
	4: MANUFACTURER:	Chemfab Corp	isible imperfection	IS
	5: PRODUCT IDENTIF	ICATION: Challenge 5	100	
	6: LOT OR MANUFACT	IRER DATE: N/A	100	
	7: NOMINAL THICKNE	SS: 15-20 mil		
	8: DESCRIPTION: N	laterial was grange co	lored on one side a	ind buff colored on the
	other side.	teter tet was orange co	noted on one side a	ing buff colored on the
2.	TEST METHOD			
			•	
	1. TESTING LABORAT	ORY: Texas Research I	nstitute. 9063 Ree	Caves Road, Austin, TX
	2. ANALYTICAL METH	OD: Continuous photo	ionization detection	n with a 11.70 eV lamp.
	3. TEMPERATURE: 22	2-25 °C		with a 11.70 et lamp.
	4. COLLECTION MEDI	UM: N2	<del></del>	
	5. COLLECTION SYST	EM: No		
	<ol><li>OTHER CONDITION</li></ol>	S: I inch cells wer	e used. /Detector T	emperature = 600
	7. DEVIATIONS FROM	ASTM F739 METHOD: FT	ow rate to cells wa	s 100 cc/min
_				200 00/11/11
3	CHALLENGE CHEMICAL	1 :	: COMPONENT 2	: 3
			•	:
	1. CHEM NAME (s) :.	Carbon Disulfide	: N/A	: N/A
	2. CAS NUMBER(s):	75-15-0	N/A	: N/A
	3. CONC. (IF MIX)	N/A	: N/A	: N/A
	4. CHEMICAL SOURCE		N/A	: N/A
	7557 0500 70	reagent grade	N/A	N/A
4.	TEST RESULTS			
	1 DATE TESTED. 1	03 1006		
	1. DATE TESTED: Ju			
	2. NUMBER OF SAMPLE	S IESIED: Inree (com	posite)	
	3. BREAKTHROUGH TIM 4. MIN DETECTABLE L	E: 21.60 min		
	5 STEADY STATE DED	IMII .IU DDM	· · · · · · · · · · · · · · · · · · ·	
	6. SAMPLE THICKNESS	MEATION RATE 2.76 ug/l	nr x cm²	
	7. SELECTED DATA PO	INTE NAME		
	7. SEEECIED DATA PO	INIS N/M		
	TIME	: CONCENTRATION		00 100 170 170 00
	1.	· CONCENTRATION	: CONCENTRATION	: CONCENTRATION
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	3.	•	<u> </u>	
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	6.	•	<del></del>	<u> </u>
	7.	•		<del></del>
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	9.			<u> </u>
	10.	•	<del></del>	<u></u>
			•	•
	8. OTHER OBSERVATION	NS •		
	a country of the second			
	·			
5.	SOURCE OF DATA			
	Samples were	run by Sylvia Cooper	on June 27 1986	

## Permeation of Carbon Disulfide through USCG Material

## Composite

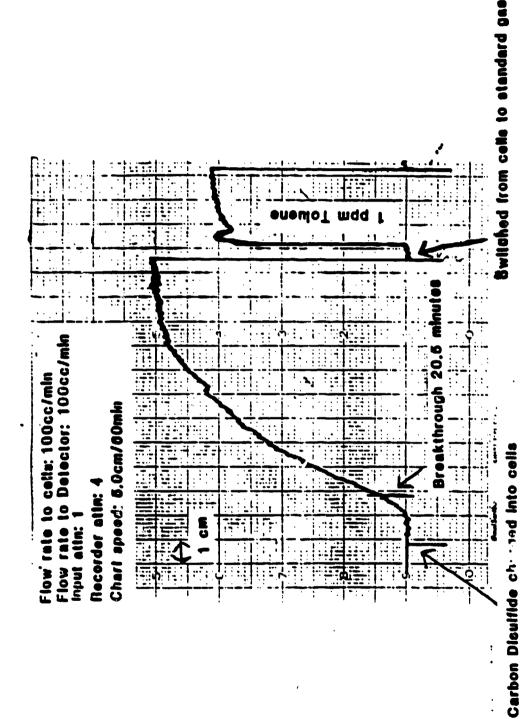


Carbon Disuifide charged into cells

1.	DESCRIPTION OF PRODUCT EVALUATED		
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no v 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange co	100	buff colored on the
2.	other side. TEST METHOD		
	1. TESTING LABORATORY: Texas Research I 2. ANALYTICAL METHOD: Continuous photo 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cell was 7. BEVIATIONS FROM ASIM F739 METHOD: F1	used. /Detector Tempe	with a 11.70 eV lamp.
3_	CHALLENGE CHEMICAL 1	: COMPONENT 2	. 3
	1. CHEM NAME(s): Carbon Disulfide 2. CAS NUMBER(s): 75-15-0 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Mallinckrodt reagent grade	N/A N/A N/A N/A N/A	N/A : N/A : N/A : N/A : N/A
4.	1. DATE TESTED: June 27, 1986 2. NUMBER OF SAMPLES TESTED: One (Run I 3. BREAKTHROUGH TIME: 20.50 min 4. MIN DETECTABLE LIMIT .05 ppm. 5. STEADY STATE PERMEATION RATE 3.65 u 6. SAMPLE THICKNESS: 18-19 mil 7. Salected DATA POINTS N/A	g/hr x cm²	
	TIME : CONCENTRATION	: CONCENTRATION	: CONCENTRATION
	5. : 6. : 7. : 8. :		
	10		<u>:</u>
	8. OTHER OBSERVATIONS:		
5.	SOURCE OF DATA Sample was run by Sylvia Cooper	on June 27, 1986	

## Permeation of Carbon Disulfide through USCG Material

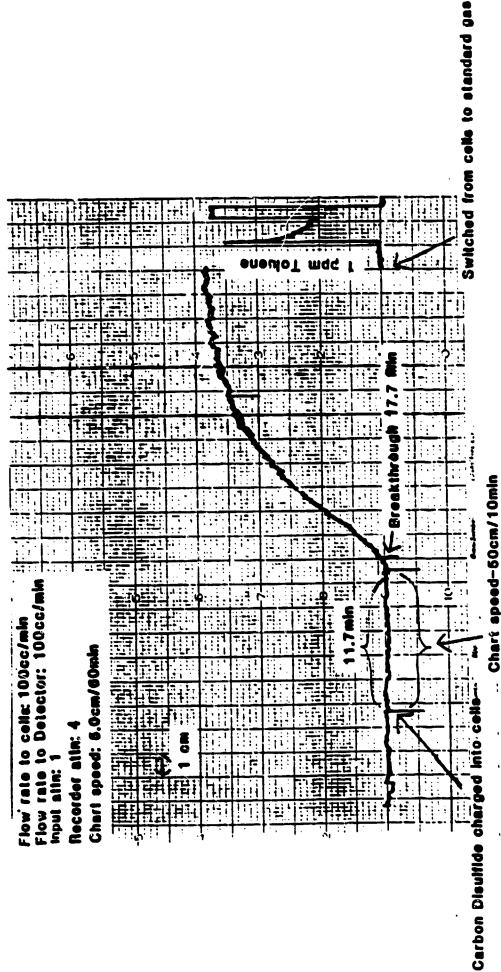
## Run 1



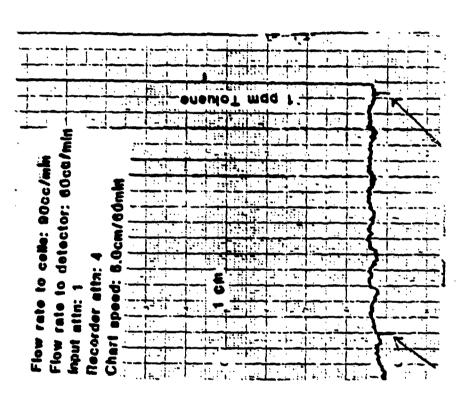
	SCRIPITUN OF PRO			
1:		laminated Nomex		
2:		ERIAL CUDE: 068		
3:	CONDITION BEFO	DRE TEST: Unused, no vi	sible imperfections	
4:		Chemfab Corp.		
5:	PRUDUCT TUENT	IFICATION: Challenge 51	00	
6:		CTURER DATE: N/A		
7:		NESS: 15-20 mil		
8:	other side.	Material was orange col	ored on one side and	buff colored on the
TE:	ST METHOD			
1.	TESTING LABOR	ATORY: Texas Research In	stitute, 9063 Bee Cav	ves Road, Austin, TX
2.	ANALYTICAL MET	HOD: Continuous photoi	onization detection w	with a 11.70 eV Tamp
3.	TEMPERATURE:			
4.	COLLECTION ME			
5.	COLLECTION SYS	STEM: N2		
6.	OTHER CONDITION	ONS: I inch cell was u	ised. /Detector Temper	ature = 60C.
7.	DEVIATIONS FR	OM ASTM F739 METHOD: Flo	w rate to cell was 10	0 cc/min.
TH	altende chemica	1 :	COMPONENT 2	.3
1.	CHEM NAME (S)	Carbon Disulfide	N/A	N/A
2.	EAS NUMBER (S)	, <u>/2-12-0</u> :	N/A	N/A
	CONC. (IF MIX	) N/A ::	N/A :	N/A
4.	CHEMICAL SOUR	CE: Mallinckrodt :	N/A	A/A
TES	T RESULTS	reagent grade :	<u>N/A</u> :	N/A
1	DATE TESTED: Je	una 20 1096		
2.	MINDED UE CYMDI	LES TESTED: One (Run II)		
	BREAKTHROUGH T			
J.	MIN DETECTABLE	IME: 1/./U MIN		
Ϊ.	CTEADY CTATE DE	ERMEATION RATE 2.59 ug/		
5	SAMPLE THICKNESS	2. 19_10 mil 2.39 ug/	AT X CIIF	
	SELECTED CATA			
	TIME	: CONCENTRATION	: CONCENTRATION :	CONCENTRATION
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8.	OTHER OBSERVAT	IUNS:		
8.	OTHER OBSERVAT	10N2:		

## Permeation of Carbon Disulfide through USCG Material

## Run II



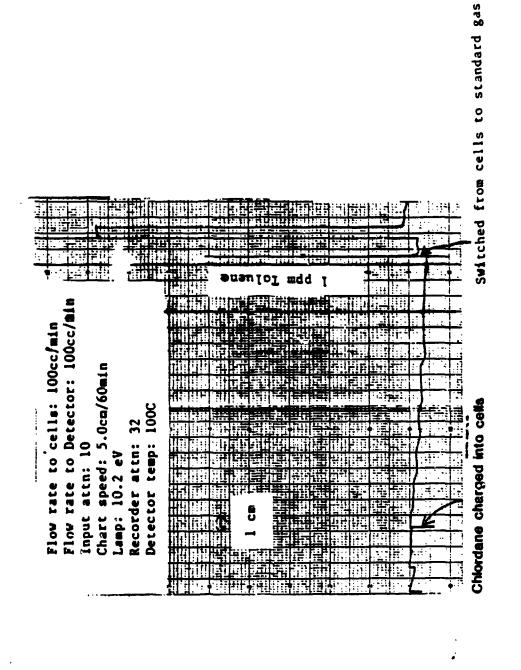
. 1	DESC	RIPTION OF I	PRODUCT E	VAL UAT ED			
	2:   3:   4:   5:   6:   7:	MANUFACTURES PRODUCT IDES LOT OR MANUS MOMINAL THIC	MATERIAL EFORE TES R: Chemf VTIFICATI FACTURER CKNESS:	CUDE: 069 T: <u>Unused, no v</u> ab Corp. ON: <u>Challenge 5</u> DATE: N/A	100	imperfections	
	TEST	METHOD					
	2. / 3. · 4. (	ANALYTICAL ( TEMPERATURE: COLLECTION ( COLLECTION ( OTHER CONCIT	METHOD: 22-25°C MEDIUM: 5YSTEM: 1 TIONS: 2	Continuous photo No No Inch cells were	ion za	te, 9063 Bee Cavition detection w /Detector Tempe e to cells was 9	rature = bOC.
- 4	CHAL	enge Chemic	AL	1	: cc	MPONENT 2 :	3
	2. (1 3. (1 4. (1 1. D.) 2. NI 3. BI 4. M. 5. S.	CAS NUMBER() CONC. (IF M) CHEMICAL SON RESULTS ATE TESTED: UMBER OF SAN REAKTHROUGH IN DETECTABL	S): 56-2 IX) N/A JRCE: Matt reag  April MPLES TES TIME: No LE LIMIT PERMEATT NESS: 17	inckrodt ent yrade 16, 1986 TED: Three breakthrough wa N/A UN RATE N/A		N/A N/A N/A N/A N/A	N/A N/A N/A N/A N/A
	1.	TIME	:	CONCENTRATION	:	CONCENTRATION :	CONCENTRATION
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•	o. U	THER OBSERVA	41 10W2: —				
		· · · · · · · · · · · · · · · · · · ·					
. :	su UR(	E OF DATA Samples v	were run	by Karen Verscho	or on	April 16. 1986	
						مستحينا السيتدينات	



Orbon Tetrachloride charged into cells, Switched from cells to etunderd gas.

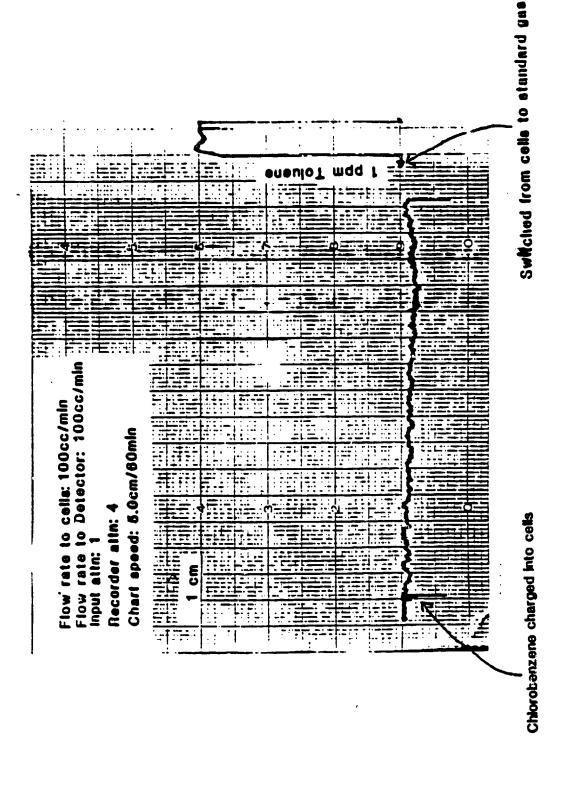
1.	DESCRIPTION OF PRODUCT EVALUATED	
	1: TYPE: Teflon laminated Nomex	
	2: PROTECTIVE MATERIAL CODE: 068	
	3: CONDITION BEFORE TEST: Unused, no	visible imperfections
	4: MANUFACTURER: Chemfab Corp.	
	5: PRODUCT IDENTIFICATION: Challenge	5100
	6: LOT OR MANUFACTURER DATE: N/A	المراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع المراجع والمراجع والمراجع والمراجع والمراجع والم
	7: NOMI NAL THICKNESS: 15-20 mil	alanad as and side and buff colored on the
	8: DESCRIPTION: <u>Material was orange contained</u>	olored on one side and buff colored on the
	other side.	
2.	TEST METHOD	
	1. TESTING LABORATORY: Texas Research	Institute, 9063 Bee Caves Road, Austin, TX
		oionization detection with a 10.20 eV lamp.
	3. TEMPERATURE: 22-25°C	
	4. COLLECTION MEDIUM: N2	
	5. COLLECTION SYSTEM: No	
	<ol> <li>OTHER CONDITIONS: 1 inch cells we</li> <li>DEVIATIONS FROM ASTM F739 METHOD:</li> </ol>	re used. /Detector Temperature = 100C.
	7. DEVIALIONS FROM ASIM F739 METHOD.	From Fate to ceits was too ct/min.
3.	CHALLENGE CHEMICAL 1	: COMPONENT 2 : 3
	1. CHEM NAME(s): Chlordane (25%)	: N/A : N/A
	2. EAS NUMBER(s): N/A	N/A N/A
	3. CONC. (IF MIX) N/A	N/A : N/A
	4. CHEMICAL SOURCE: Voluntary Product	: N/A : N/A
	group	: N/A : N/A
4.	TEST RESULTS	
	1 MATE TEETEN. Contambon 0 1005	
	1. DATE TESTED: <u>September 9, 1986</u> 2. NUMBER OF SAMPLES TESTED: Three	
	3. BREAKTHROUGH TIME: No breakthrough w	as observed after 3.44 hours.
	4. MIN DETECTABLE LIMIT 0.26 ppm	23 0330, 103 0,101 0,111
	5. STEADY STATE PERMEATION RATE N/A	
	6. SAMPLE THICKNESS: 18-19 mil	
	7. SELECTED DATA POINTS N/A	
	TIME : CONCENTRATION	: CONCENTRATION : CONCENTRATION
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	<u>3.</u>	
	4.	
	5	:
	6:	
	7.	<u></u>
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	9. : 10. :	
	100	
	8. OTHER OBSERVATIONS:	
5.	SOURCE OF DATA	
	Samples were run by Denise McDor	ald on September 9, 1986.

## Chemical Resistance Testing of USCG Material with Chlordane



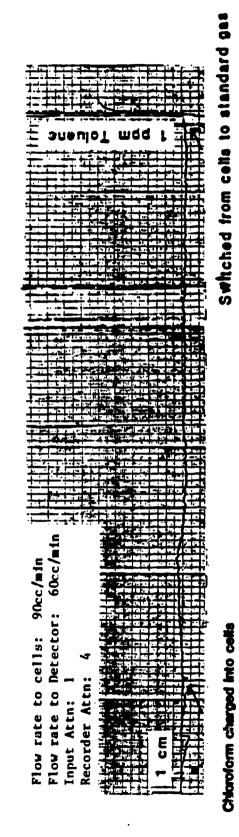
•	DESCRIPTION OF PRODUCT EVALUATED			
	1: TYPE: Teflon laminated Nomex			
	2: PROTECTIVE MATERIAL CODE: 068			
	3: CONDITION BEFORE TEST: Unused, no	visible imperfection	S	
	4: MANUFACTURER: Chemfab Corp.			
	5: PRODUCT IDENTIFICATION: Challenge	100		
	6: LOT OR MANUFACTURER DATE: N/A			
	7: NOMINAL THICKNESS: 15-20 mil			
	8: DESCRIPTION: Material was orange co	lored on one side a	nd bu	ff colored on the
	other side.			
	TEST METHOD			
			_	
	1. TESTING LABORATORY: Texas Research 1			
	2. ANALYTICAL METHOD: Continuous photo	lonization detection	n wit	h a 11./U eV lamp.
	3. TEMPERATURE: 22-25°C			
	4. COLLECTION MEDIUM: N2			
	5. COLLECTION SYSTEM: N2	/5		
	6. OTHER CONDITIONS: 1 inch cells we			
	7. DEVIATIONS FROM ASTM F739 METHOD:	TON LUCE ID COTTE .	<b>25 1</b> 0	O SELMIN-
•	CHALLENGE CHEMICAL 1	: COMPONENT 2	:	3
	1. CHEM NAME(s): Chlorobenzene	: X/A	:	n/a
	2. CAS NUMBER(s): 108-90-7	N/A	<u>:</u>	N/A
	3. CONC. (IF MIX) N/A	N/A	<u>:</u>	N/A
	4. CHEMICAL SOURCE: Aldrich reagent	N/A	:	N/A
	grade	N/A	:	N/A
	TEST RESULTS	·	'	N/A
	1. DATE TESTED: July 16, 1986			
	2. NUMBER OF SAMPLES TESTED: Three			
	3. BREAKTHROUGH TIME: No breakthrough v	was observed after 3	hour	's •
	4. MIN DETECTABLE LIMIT .20 ppm			
	5. STEADY STATE FERMEATION RATE N/A			
	6. SAMPLE THICKNESS: 18-19 mil			
	7. SELECTED DATA POINTS N/A			
	TIME : CONCENTRATION	: CONCENTRATION	i :	CONCENTRATION
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	8. OTHER OBSERVATIONS:			
				<del></del>
•	SOURCE OF DATA			
	Samples were run by Sylvia Coope	r on July 16, 1986		

# Chemical Resistance Testing of USCG Material with Culorobenzene



	4: MANUFACTURER: C			
		CATION: Challenge 51	00	
	6: LOT OR MANUFACTUMES 7: NOMINAL THICKNES			
		iterial buff colored		
•	TEST METHOD			
	1. TESTING LABORATO	RY: Texas Research In	stitute, 9063 Bee Ca	ves Road, Austin, T
	<ol> <li>ANALYTICAL METHO</li> <li>TEMPERATURE: 22-</li> </ol>	D: Continuous photoi	onization detection i	with a 11./U eV lan
	4. COLLECTION MEDIT	IM: No		
	5. COLLECTION SYSTE	M: N <sub>2</sub>		
	<ol> <li>OTHER CONDITIONS</li> <li>DEVIATIONS FROM</li> </ol>	: 2 inch cells were ASTM F739 METHOD: F1	used. /Detector Tem	perature = 60C.
	7. DETINITIONS FROM	ASIM F/39 METHOD: FI	ow race to cerrs was	90 CC/min
1	CHALLENGE CHEMICAL	1 :	COMPONENT 2	3
	1. CHEM NAME (s):	<u>Chloroform</u>	N/A	N/A
	2. CAS MEMBER (s):	865-49-6	N/A	N/A
	3. CONC. (IF MIX) 4. CHEMICAL SOURCE:	N/A Kodak	N/A N/A	N/A N/A
	VIII. 1942 3001.02.	reagent grade :	N/A	N/A
•	TEST RESULTS			
	1 DATE TESTED. A	.41 04 1006		
	1. DATE TESTED: Apr	11 24, 1986 ·		
	1. DATE TESTED: Apr 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME	TESTED: Three	as observed after 3.6	hours
	2. NUMBER OF SAM <mark>PLES</mark> 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI	TESTED: Three : No breakthrough w. MIT 0.19 ppm	as observed after 3.6	hours
	2. NUMBER OF SAM <mark>PLES</mark> 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM	TESTED: Three : No breakthrough w. MIT 0.19 ppm EATION RATE N/A	as observed after 3.6	hours
	<ol> <li>NUMBER OF SAMPLES</li> <li>BREAKTHROUGH TIME</li> <li>MIN DETECTABLE LI</li> <li>STEADY STATE PERM</li> <li>SAMPLE THICKNESS:</li> </ol>	TESTED: Three: : No breakthrough womit 0.19 ppm EATION RATE N/A 17-19 mil	as observed after 3.6	hours
	2. NUMBER OF SAM <mark>PLES</mark> 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM	TESTED: Three: : No breakthrough womit 0.19 ppm EATION RATE N/A 17-19 mil	as observed after 3.6	hours
	2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI	TESTED: Three: : No breakthrough womit 0.19 ppm EATION RATE N/A 17-19 mil	es observed after 3.6	CONCENTRATION
	2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI	TESTED: Three : No breakthrough womit 0.19 ppm EATION RATE N/A 17-19 mil NTS N/A		
	2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME 1. 2.	TESTED: Three : No breakthrough womit 0.19 ppm EATION RATE N/A 17-19 mil NTS N/A		
	2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI	TESTED: Three : No breakthrough womit 0.19 ppm EATION RATE N/A 17-19 mil NTS N/A		
	2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME 1. 2. 3. 4. 5.	TESTED: Three : No breakthrough womit 0.19 ppm EATION RATE N/A 17-19 mil NTS N/A		
	2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME 1. 2. 3. 4. 5. 6.	TESTED: Three : No breakthrough womit 0.19 ppm EATION RATE N/A 17-19 mil NTS N/A		
	2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME 1	TESTED: Three : No breakthrough womit 0.19 ppm EATION RATE N/A 17-19 mil NTS N/A		
	2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME 1	TESTED: Three : No breakthrough womit 0.19 ppm EATION RATE N/A 17-19 mil NTS N/A		
	2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME 1	TESTED: Three : No breakthrough womit 0.19 ppm EATION RATE N/A 17-19 mil NTS N/A		
	2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME 1	TESTED: Three : No breakthrough womit 0.19 ppm EATION RATE N/A 17-19 mil NTS N/A  CONCENTRATION		
	2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME 1	TESTED: Three : No breakthrough womit 0.19 ppm EATION RATE N/A 17-19 mil NTS N/A  CONCENTRATION	: CONCENTRATION	

## Chemical Resistance Testing of USCG Material with Chloroform

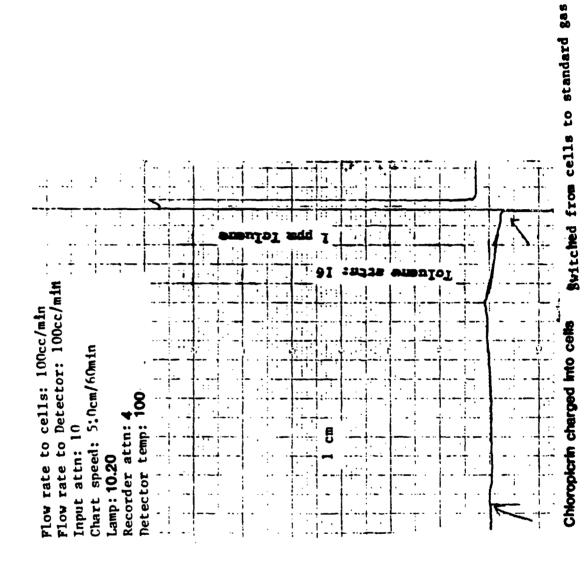


DESCRIPTION OF PRODUCT EVALUATED

	1: TYPE: Teflon laminated Nomex
	2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections
	4: MANUFACTURER: Chemfab Corp.
	5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A
	7: NOMINAL THICKNESS: 15-20 mil
	8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.
	TEST METHOD
•	
	<ol> <li>TESTING LABORATORY: <u>Texas Research Institute</u>, <u>9063 Bee Caves Road</u>, <u>Austin</u>, <u>TX</u></li> <li>ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp.</li> </ol>
	3. TEMPERATURE: 22-25°C
	4. COLLECTION MEDIUM: N2  5. COLLECTION SYSTEM: N2
	6. OTHER CONDITIONS: 1 inch cells were used. /Detector Temperature = 100C.
	7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min.
-	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. CHEM NAME(s): Chloropicrin : N/A : N/A
	2. CAS NUMBER(s): 76-06-2: N/A : N/A
	3. CONC. (IF MIX) N/A : N/A : N/A
	grade : N/A : N/A
•	TEST RESULTS
	1. DATE TESTED: October 15, 1986
	2. NUMBER OF SAMPLES TESTED: Three
	3. BREAKTHROUGH TIME: No breakthrough was observed after 3.1 hours.
	4. MIN DETECTABLE LIMIT 1.80 ppm
	5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil
	7. SELECTED DATA POINTS N/A
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
	1:::::::
	3.
	4. <u>:</u> : : : : : : : : : : : : : : : : : :
	ő. ————————————————————————————————————
	7
	8
	10.
	9 OTHER ORCEDIATIONS.
	8. OTHER OBSERVATIONS:
	SOURCE OF DATA
•	Samples were run by Denise McDonald on October 15, 1986.

1.

## Chemical Resistance Testing of USCO Material with Chloropicrin



l.	. DESCRIPTION OF PRODUCT EVALUATED	
	1: TYPE: Teflon laminated Nomex	
	2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections	
	4: MANUFACTURER: Chemfab Corp.	
	5: PRODUCT IDENTIFICATION: Challenge 5:00	
	6: LOT OR MANUFACTURER DATE: N/A	
	7: NOMINAL THICKNESS: 15-20 mil	
	8: DESCRIPTION: <u>Material was orange colored on one side and buff contains the side.</u>	olored on the
2.	TEST METHOD	
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Roa	d, Austin, TX
	2. ANALYTICAL METHOD: Ion Chromatography on Dionex 2000	
	3. TEMPERATURE: Ambient	
	4. COLLECTION MEDIUM: Aqueous 5. COLLECTION SYSTEM: Aqueous	
	6. OTHER CONDITIONS: 2 inch cells were used.	
	7. DEVIATIONS FROM ASTM F739 METHOD:	
<b>)</b> -	. CHALLENGE CHEMICAL 1 : COMPONENT 2 :	3
	1. THEM NAME(s): Chiorosulfonic Acid: N/A :	11/3
	2. CAS NUMBER(s): 7790-94-5 : N/A :	N/A
	3. CONC. (IF MIX) 96% : N/A :	N/A
	4. CHEMICAL SOURCE: Aldrich reagent : N/A :	N/A
	grade : N/A :	N/A
	1. DATE TESTED: October 10, 1986	
	2. NUMBER OF SAMPLES TESTED: Three	
	3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT 0.5 ppm	
	5. STEADY STATE PERMEATION RATE N/A	
	6. SAMPLE THICKNESS: 19-20 mil	
	7. SELECTED DATA POINTS Cells 1,2, and 3 at end of 3 hour test	
		CENTRATION
		<b>€0.5</b> ppm
	2	
	5.	
	6. : : :	<del></del>
	7	
	8	
	9	
	8. OTHER OBSERVATIONS: Pelention time for 5 ppm Chlorosulfonic Acid	standard was
	SOURCE OF DATA	
•	Samples were run by Denise McDonald on October 10, 1986.	

## Calibration-5 ppm Chlorosulfonic Acid STD

CHANNEL A

INJECT

21106129

	1				
=	2				_
e e e e e e e e e e e e e e e e e e e	•	21:06:29	CH# "A"	PS=	4

Chlorosultonic Acid Cell 1 3 hours

CHANNEL A INJECT

#EMMEATION 21:06:29 CH# "A"

#ILE 1. METHOD S. RUN 42 INDEX 1 CALIB

ANALYST: DJM

MAME FFM RT AREA 6C FF

0. 1.25 527812 01

CL 5. 2.08 16557995 01,311597.

TOTALS 5. 17035797

	2. 05		
PERMEATION	4.03	•	21: 20: 10
FILE 1.	METHOD 5.	RUH 48	
AMALYST: DJM			
HAME	PPH	RT	APEA BC
CL <sup>2</sup>	9. 9.34	e. e? 2. e5	11 <b>0</b> 710 0: 116192'
TOTALS	ð.	2	1272-

21:20:10

## MDL-0.5ppm Chlorogulfonic Acid STD

CHANNEL A

INJECT

21:15:0

1.25

Permeation .			21:1	6: 98
File 1. M	ETH03 <b>5.</b>	RUN 4	IHE	)E:( 1
SNALYST: DJM				
HAME	FFM	RT	AREA	SC RF
et <sup>1</sup>	0. 8. 618	1. 25 2. 29	385687 2041375	01 013211597.
117443	ર. 61 ક		2421062	

Chlorosulfoni	c Acid	Cell 2	3 Hours
CHAMIET N	753LNI 76. − 76. <del>−</del>	211;	75:47
PERMEATION			21:33:97
FILE 1.	METHOD 5.	RUM 4	9 INDEX
ARELYST: DIM			
NAME	seM	RT	AREA BC
cu.i	ე. ე. ე⊯	0. 37 2. 85	
TUTALS	₽.	2.20	1162150

## Reagent Water Blank

CHANNEL A INJECT

TOTALS

21:47:13

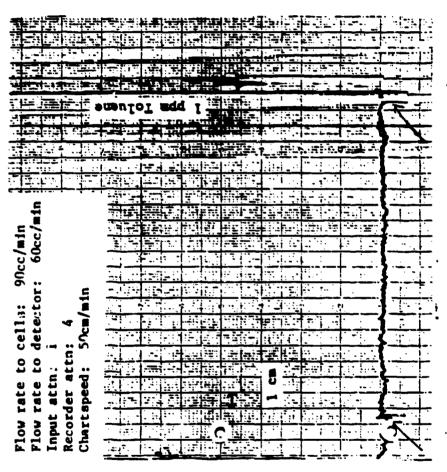
532059

Chlorosulton	ic Acid	Cell 3	3 Hours	1
CHONNEL A	1.31 01 01	21	: 43: 09	1
FERMEATION	METHOD S.	PUN	21:4 21 INI	it: 09 EK
ANALYST: DJM	•			
HAME	हरत	RT	AREA	SC
cr.	ə. ə.45	9. 9 3. 0		
TOTALS	٥.		1617817	

1.	DESCRIPTION OF PRODU	CI E VALUATED		
	1: TYPE: Teflon lam	dashad Nasau		•
		TEST: Unused, no vi	eible imperfections	
	4: MANUFACTURER: C	hemfab Corp.	STOTE IMPERIECCIONS	
		CATION: Challenge 51	00	
	6: LOT OR MANUFACTU			
	7: NOMINAL THICKNES			
		iterial was buff color	ed	
	<u> </u>			
2.	TEST METHOD		•	
	1. TESTING LABORATO	RY: <u>Texas Research In</u>	<u>stitute, 9063 Bee Cav</u>	es Road, Austin, TX
		D: Continuous photoi	onization detection w	ith a 11.70 eV Tamp.
	3. TEMPERATURE: 22-			
	4. COLLECTION MEDIU			
	5. COLLECTION SYSTE			
		: 2 inch cells were		
	7. DEVIATIONS FROM	ASTM F739 METHOD: F1	ow rate to cells was	Occ/min
3.	CHALLENGE CHEMICAL	1 :	COMPONENT 2 :	3
٥.	CHALLERGE CHEMICAL	•	COMPUNENT 2	3
	1. CHEM NAME(s):	m-Cresol :	N/A	N/A
		108-39-4	N/A	N/A
	3. CONC. (IF MIX)	N/A :	N/A	N/A
	4. CHEMICAL SOURCE:		N/A	N/A
	4. CHEMICAL SOCKER.	reagent grade :	:	N/A
4.	TEST RESULTS	- casent grade		
• • •	100 1 110000110			
	1. DATE TESTED: Apr	·il 7. 1986		
	2. NUMBER OF SAMPLES			
	3. BREAKTHROUGH TIME	: No breakthrough w	as observed after 4 h	ours
	4. MIN DETECTABLE LI	MIT 0.03 ppm		
	5. STEADY STATE PERM	EATION RATE N/A		
	6. SAMPLE THICKNESS:	17-19 mil		
	7. SELECTED DATA POI	INTS N/A		
	TIME :	CONCENTRATION	: CONCENTRATION :	CONCENTRATION
	1		<u>:</u>	
	2.		<u>:</u>	
	3.			
	4.			
	5.	·		
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	ε.		<u> </u>	
	9.		<del></del>	
	10.		<del></del>	
	10,		<u> </u>	
	8. OTHER OBSERVATION	ıc •		
	O. OTHER SESEMINITOR	· .		
5.	SOURCE OF DATA			
٠.		run by Karen Verschoo	r on April 7 1986	
	Adult E2 MELE	THE ST REIGHT TELSCHOOL	VII AVI 11 / 1300	

## Chemical Resistance Testing of USCG Material with Cresol

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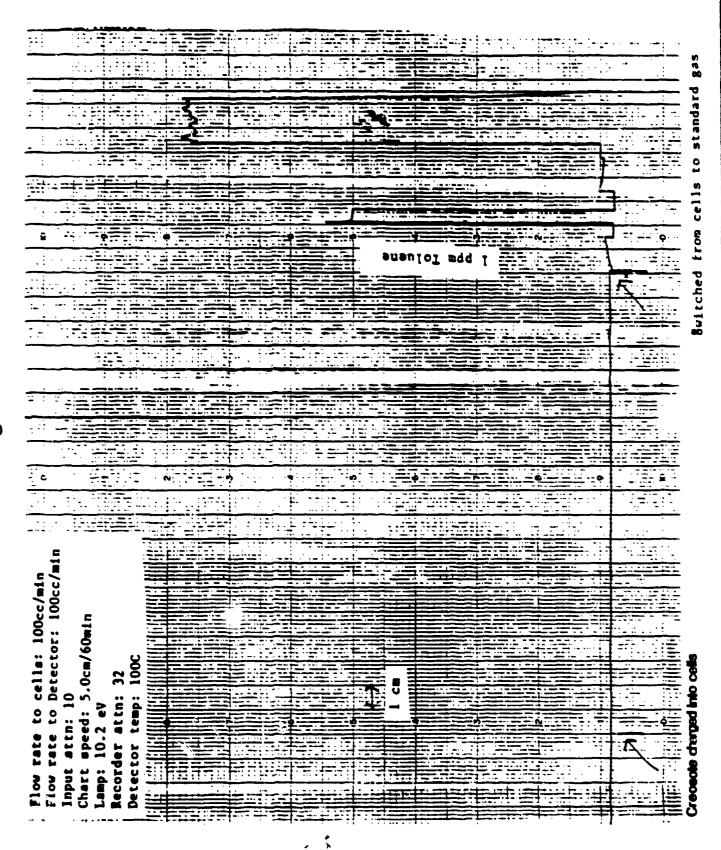


Creeol charged into ceile

Switched from cells to standard ga

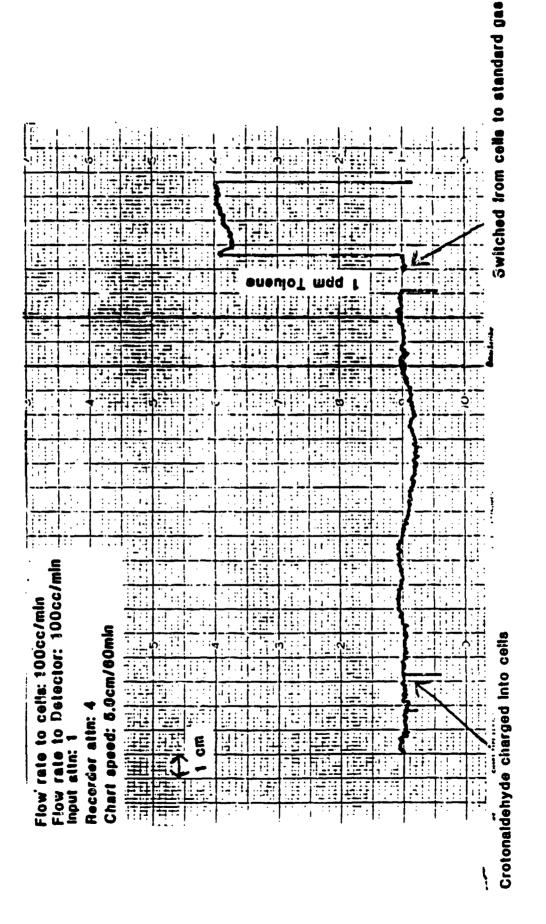
1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the
2.	other side. TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION SYSTEM: N <sub>2</sub> 6. OTHER CONDITIONS: 1 inch cells were used. /Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F739 METHOD: N/A
1	ENALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. CHEM NAME(s): Creosote
4.	TEST RESULTS  1. DATE TESTED: August 18, 1986  2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 18.1 hours.  4. MIN DETECTABLE LIMIT .32 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 18-19 mil  7. SELECTED DATA POINTS N/A
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION : :
	2. 3.
	4
	6
	8.
	9
	8. OTHER OBSERVATIONS:
5.	SOURCE OF DATA Samples were run by Sylvia Cooper on August 18, 1986

Chemical Resistance Testing of USCG with Creosote

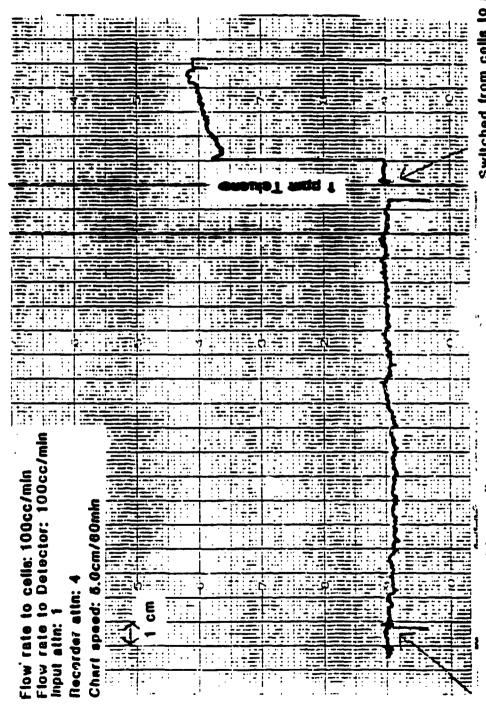


4: M	ANUFACTURER: C	TEST: Unused, no vishemfab Corp.		
			<u> </u>	
8: D	ESCRIPTION: Ma		ored on one side and	buff colored on the
TEST	METHOD			
1. 7	ESTING LABORATO	RY: <u>Texas Research In</u>	titute, 9063 Bee Cav	es Road, Austin, TX
2. A	NALYTICAL METHO	D: <u>Continuous photoic</u>	nization detection w	ith a 11.70 eV lamp.
4. C	OLLECTION MEDIU	Z5 C M: N2		
5. C	OLLECTION SYSTE	M: N <sub>2</sub>	<del></del>	
6. 0	THER CONDITIONS	: linch cells were	used. /Detector Tem	perature = 60C.
7. D	EVIATIONS FROM	ASTM F739 METHOD: Flo	rate to cells was 1	00 cc/min.
CHALL	ence chemical	1 :	COMPONENT 2 :	3
			N/A	N/A
				N/A
				N/A N/A
7. 0				N/A
TEST			·	
1.	TIME :	CONCENTRATION	: CONCENTRATION :	CONCENTRATION
2.				
3.	:			
4.				
6.				
7.				
8.			<u> </u>	
10	· ·			
		<del></del>		
8. OT	HER OBSERVATION	S:		
SOURC	E OF DATA Samples were	run by Sylvia Cooper	on July 15, 1986.	
SOURC		run by Sylvia Cooper	on July 15, 1986.	
	5: PL. N. D. S. T. S. T. T. A. T. C. C. D. D. L. S. C. C. T. S. T. C. C. C. T. S. T. S.	5: PRODUCT IDENTIFTO 6: LOT OR MANUFACTUR 7: NOMINAL THICKNES: 8: DESCRIPTION: Ma other side.  TEST METHOD  1. TESTING LABORATO 2. ANALYTICAL METHO 3. TEMPERATURE: 22- 4. COLLECTION MEDTU 5. COLLECTION SYSTE 6. OTHER CONDITIONS 7. DEVIATIONS FROM  CHALLENGE THEMICAL  1. EMBN NAME(s): 2. CAS NUMBER(s): 3. CONC. (IF MIX) 4. CHEMICAL SOURCE:  TEST RESULTS  1. DATE TESTED: Jul 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI	5: PRODUCT IDENTIFICATION: Challenge 510 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange color other side.  TEST METHOD  1. TESTING LABORATORY: Texas Research Instance Continuous photoic Continuous photoic Continuous photoic Continuous photoic Collection MeDIUM: N2 6. COLLECTION MEDIUM: N2 6. OTHER CONDITIONS: 1 inch cells were Collection System: N2 6. OTHER CONDITIONS: 1 inch cells were CONDITIONS: 1 inch cells were COMPLENGE CHEMICAL 1 1. EMEM HAME(s): Crotonal dehyde: 123-73-9 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Aldrich reagent: grade  TEST RESULTS  1. DATE TESTED: July 15, 1986 2. NUMBER OF SAMPLES TESTED: Three CONCENTABLE LIMIT 0.62 ppm. 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and other side.  TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Cave 2. ANALYTICAL METHOD: Continuous photoionization detection will also collection Medium: No. 5. COLLECTION MEDIUM: No. 5. COLLECTION SYSTEM: No. 6. OTHER CONDITIONS: 1 inch cells were used. /Detector Tem 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 1  CHALLENGE CHEMICAL 1 : COMPONENT 2:  1. DAMEN NAME(s): Crotonal dehyde: N/A: 2. CAS NUMBER(s): 123-73-9 : N/A: 3. CONC. (IF MIX) N/A: N/A: N/A: N/A: N/A: N/A: N/A: N/A:

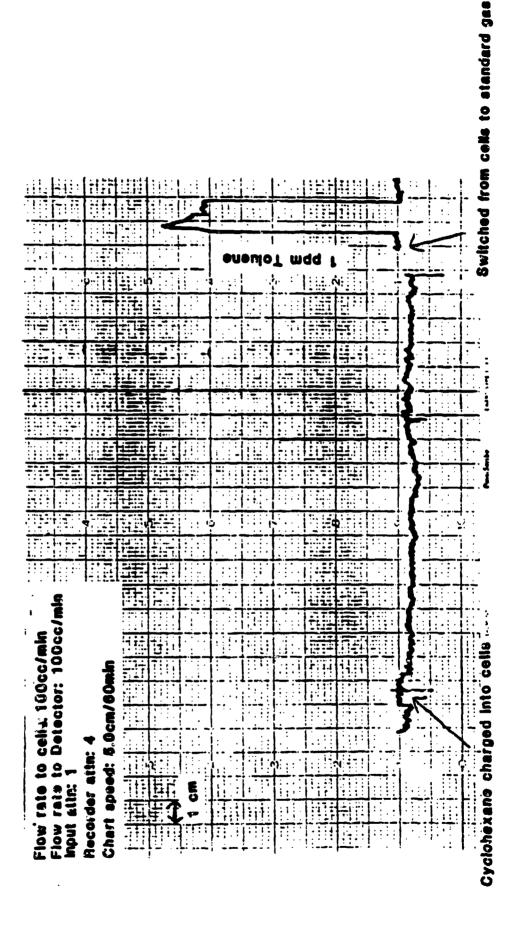
Chemical Restance Testing of USCG Material with Crotonaldehyde



	DESCRIPTION OF PRODUCT EAST ONLED			
	1: TYPE: Teflon laminated Nomex		·	
	2: PROTECTIVE MATERIAL CODE: 068			
	3: CONDITION BEFORE TEST: Unused, no	<u>visible imperfecti</u>	ons	
	4: MANUFACTURER: Chemfab Corp.			
	5: PRODUCT IDENTIFICATION: Challenge	5100		
	6: LOT OR MANUFACTURER DATE: N/A			
	7: NOMINAL THICKNESS: 15-20 mil			
	8: DESCRIPTION: Material was orange cother side.	olored on one side	and D	utt colored on the
2.	TEST METHOD			
	1. TESTING LABORATORY: Texas Research	Institute, 9063 Be	e Cave	s Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous phot	<u>oionization detect</u>	ion wi	th a 11.70 eV lamp.
	3. TEMPERATURE: 22-25°C			
	4. COLLECTION MEDIUM: N2			
	5. COLLECTION SYSTEM: N2			
	6. OTHER CONDITIONS: 1 inch cells we	re used. /Detecto	r Temp	erature = 60C.
	7. DEVIATIONS FROM ASTM F739 METHOD: F	low rate to cells	was 100	cc/min.
<b>L</b>	CHALLENGE CHEMICAL 1	: COMPONENT 2	:	3
	1. CHEM NAME(s): Cumene Hydroperoxid	e: N/A	:	N/A
	2. CAS NUMBER(s): 80-15-9	N/A		N/A
	3. CONC. (IF MIX) N/A	: N/A		N/A
	4. CHEMICAL SOURCE: Aldrich reagent	: N/A	:-	N/A
	grade	: N/A		N/A
١.	TEST RESULTS			
	1 DATE TECTED 1 1 14 1000			
	1. DATE TESTED: July 14, 1986			
	2. NUMBER OF SAMPLES TESTED: Three		<del></del>	<del></del>
	3. BREAKTHROUGH TIME: No breakthrough	was observed after	. 3.5 h	ours.
	4. MIN DETECTABLE LIMIT 1.20 ppm 5. STEADY STATE PERMEATION RATE N/A			
	6. SAMPLE THICKNESS: 18-19 mil			
	6. SAMPLE THICKNESS: 18-19 mil	: CONCENTRATI	ON :	CO NCENTRATION
	6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION	: CONCENTRATI	ON :	CONCENTRATION
	6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. :	: CONCENTRATI	ON :	CONCENTRATION
	6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : 2. :	: CONCENTRATI	ON : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : 2. :	: CONCENTRATI	ON :	CONCENTRATION
	7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1	: CONCENTRATI	ON :	CONCENTRATION
	6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : 2. :	: CONCENTRATI	ON :	CONCENTRATION
	7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1	: CONCENTRATI	ON :	CONCENTRATION
	6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1	CONCENTRATI	ON : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :	CONCENTRATI	ON :	CONCENTRATION
	6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1	CONCENTRATI	ON : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1	CONCENTRATI	ON :	CONCENTRATION
	6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1	: CONCENTRATI	ON :	CONCENTRATION
	6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1	: CONCENTRATI	ON :	CONCENTRATION
•	6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :			CONCENTRATION
•	6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1			CONCENTRATION



1.	DESCRIPTION OF PRODUCT EAST OWLED				
	1: TYPE: Teflon laminated Nomex	,			
	2: PROTECTIVE MATERIAL CODE: 06				
	3: CONDITION BEFORE TEST: Unus		hlu importactio	25	
		eu, 110 V 15 1	DIE IMPELIECTIO	112	
	4: MANUFACTURER: Chemfab Corp.	1 F 3 (1)			
	5: PRODUCT IDENTIFICATION: Cha				
	6: LOT OR MANUFACTURER DATE: N/				
	7: NOMINAL THICKNESS: 15-20 mi				
	8: DESCRIPTION: Material was o	range color	ed on one side	and buff	colored on the
	other side.				
_					
2.	TEST METHOD				
	1 TECTING LABORATORY, Tamas 0.		dauda OGEO Dan	C' D	and Assault TV
	1. TESTING LABORATORY: Texas Re				
		us photolon	ization detecti	on with	a 11./ ev lamp.
	3. TEMPERATURE: 22-25°C		عميور و معرب مراسور		والمراجع
	4. COLLECTION MEDIUM: No				
	5. COLLECTION SYSTEM: No				
			sed. / Detector		
	7. DEVIATIONS FROM ASTM F739 ME	THOD: Flow	rate to cells	was 100	cc/min.
_					_
3.	CHALLENGE CHEMICAL 1	•	COMPONENT 2	•	3
	1 CUEM AMME(a) . Cual aboves	•		:	
	1. CHEM MAME(s): Cyclohexane				
	2. CAS NUMBER(s): 110-82-7			<u>:</u>	
	3. CONC. (IF MIX) N/A			<u>:</u>	
	4. CHEMICAL SOURCE: Aldrich Trag	ent:		:	
	grade	:	······································	<b>:</b>	
	EST RESULTS				
	1 DATE TECTED. 1.1. 2 1006				
	1. DATE TESTED: July 3, 1986				
	2. NUMBER OF SAMPLES TESTED: Thr			A 1	
	3. BREAKTHROUGH TIME: No break		observed atter	3.4 nou	rs.
	4. MIN DETECTABLE LIMIT .25 ppm				كيبي ديدار سيبانسي النابال يبسالان السبب
	5. STEADY STATE PERMEATION RATE	N/A			
	6. SAMPLE THICKNESS: 18-19 mil				
	7. SELECTED DATA POINTS N/A		المروري والمناب كالماكون والمواوي		
	7115 001051		00.100.1170.171.0	N . C	0.405450.4T104
	TIME : CONCEN	TRATION :	CONCENTRATIO	N : U	ONCENTRATION
	i			<del></del>	
	2.			<del></del>	
	3				
	4.				
	5. <u> </u>				
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	8				
	9				
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	•				
	8. OTHER OBSERVATIONS:				
5.	SOURCE OF DATA				
	Samples were run by Sylv	via Cooper o	n July 3, 1986		

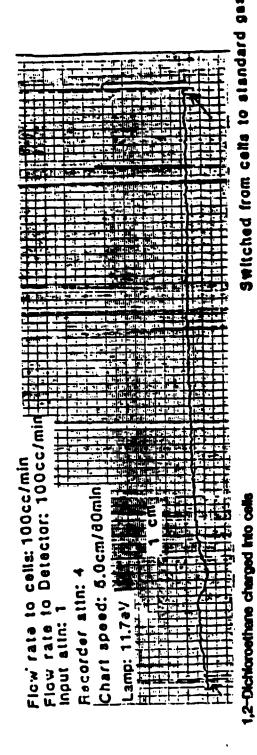


1:	TYPE: Teflon l	aminated Nomex		
2:	PROTECTIVE MATERIAL CODE: 068 CONDITION BEFORE TEST: Unused, no visible imperfections MANUFACTURER: Chemfab Corp. PRODUCT IDENTIFICATION: Challenge 5100 LOT OR MANUFACTURER DATE: N/A NOMINAL THICKNESS: 15-20 mil			
3:				
4:				
8:	DESCRIPTION:	Material was buff colo	red.	
TE	ST METHOD  TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, T			
1.				
	ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lam			
	TEMPERATURE: 22-25°C  COLLECTION MEDIUM: N2  COLLECTION SYSTEM: N2  OTHER CONDITIONS: 2 inch cells were used. /Detector Temperature = 60C.  DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100cc/min.			
4.				
5.				
6.				
./.	DEVIATIONS FRO	M ASIM F/39 ME HOU: FI	ow rate was 100cc/m	n.
CH	ALLENGE CHEMICAL	1 :	COMPONENT 2	: 3
1.	CHEM NAME (s) :	1,2 Dibromoethane :	N/A	W/A
2.	CAS NUMBER(s):	106-93-4	N/A	: N/A
	CONC. (IF MIX)	N/A :	Ä/Ä	:/A
4.	CHEMICAL SOURC	E: Aldrich reagent :	N/A N/A	
TE:	ST RESULTS	grade :	N/A	: N/A
1.	DATE TESTED: May 12, 1986			
	NUMBER OF SAMPLES TESTED: Three			
	BREAKTHROUGH TIME: No breakthrough was observed after 5 hours.			
	MIN DETECTABLE LIMIT .10 ppm			
		RMEATION RATE N/A		· · · · · · · · · · · · · · · · · · ·
6.	SAMPLE THICKNES	S: 17-19 mil		
7.	SELECTED DATA P	OINTS N/A		
	TIME 1.	: CONCENTRATION	: CONCENTRATION	: CONCENTRATION
	2.			:
	3.	:	•	:
	<del>2.</del>		<u>:</u>	<del></del>
	5.			<u>:</u>
	6	<del></del>	<u>:</u>	<u>:</u>
	8.	·	<u> </u>	•
	9: ———	•	•	<del>:</del>
	10.	•	•	;
•				
8.	OTHER OBSERVATI	UNS:		
			· · · · · · · · · · · · · · · · · · ·	
SO	URCE OF DATA			
	Complete trans	e run by Karen Verschoo	r on May 12 1986.	
	Samples wer	E I GII DY KETEN TELSCHOO	1 011 1107 12, 1900	

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celle: 100cc/min Detector: 100cc	3				<del>  -</del> :				) Ti
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		1		H inte		1100		100	
to cells: 100cc/m/n to Detector: 100cc 1	Chart speed: 6.0cm		1 .		h. h.	[	Fil		
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	TYPE: Teflor PROTECTIVE M					
				sible imperfection	ns	
	MANUFACTURER					
			ON: Challenge 51	.00		
<b>:</b>	LOT OR MANUF	ACTURER	DATE: N/A			
	NOMINAL THIC					
3:	DESCRIPTION:	Materi	al was buff color	ed.		
TES	T METHOD					
i .	TESTING LABO	RATORY:	Texas Research In	stitute, 9063 Bee	Caves	Road, Austin.
				onization detecti		
	TEMPERATURE:					
	COLLECTION M					
<b>5.</b>	COLLECTION S	151E:	<b>%</b> 7			
<b>.</b>	OTHER CONDIT	IONS:	inch cells were	used		
•	DEVIATIONS P	SON YES	2739 157110D: F.	ow rate to cells	vas 90	ce/min.
HΑ	LLENCE CHEMIC	AL	1 :	COMPONENT 2	:	3
	CHEM NAME(s)	: 1.2	: : Dichloroethane:	n/a	:	N/A
2 _	CAS NUMBER(	i): 107	-06-2	N/A		N/A
	CONC. (IF MI	X) N/A		N/A	;_	N/A
	CHEMICAL SOU	RCE: Ald	rich reagent ·	N/A	;_	N/A
		gra		N/A	:_	N/A
ES	T RESULTS					
	5.00		1004			
	DATE TESTED:					
	NUMBER OF SAM			a shaamad adaan	£ 7 L-	
•	MIN DETECTABL	TITLE: N	O DESTITUTED AS	s observed after	J./ 00	01.2
			ON RATE N/A			
	SAMPLE TEICEN					
	SELECTED DATA				~-	
			· · ·	<del> </del>		
	TIME	:	CONCENTRATION	: CONCENTRATIO	N :	CONCENTRATION
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	6.	-:	<del></del>	:		
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	OTHER OBSERVA	TIONS: _				
	OTHER OBSERVA	TIONS: _				

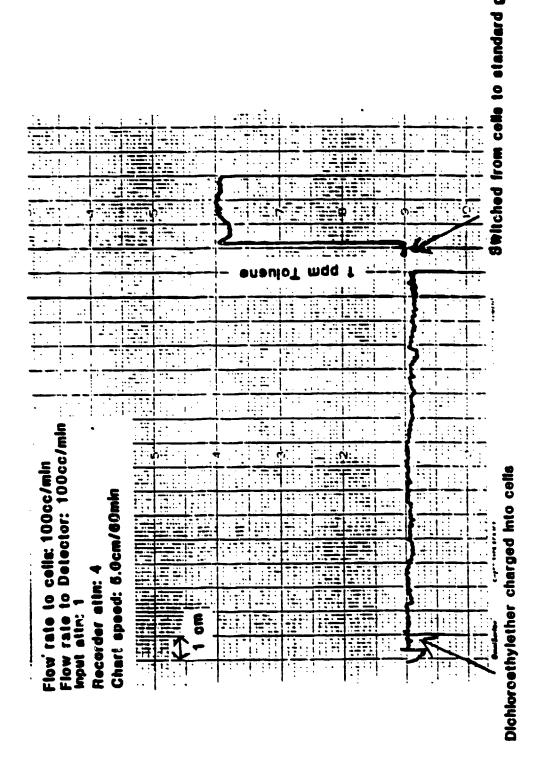
### Chemical Resistance Testing of USCG Material with 1,2-Dichloroethane



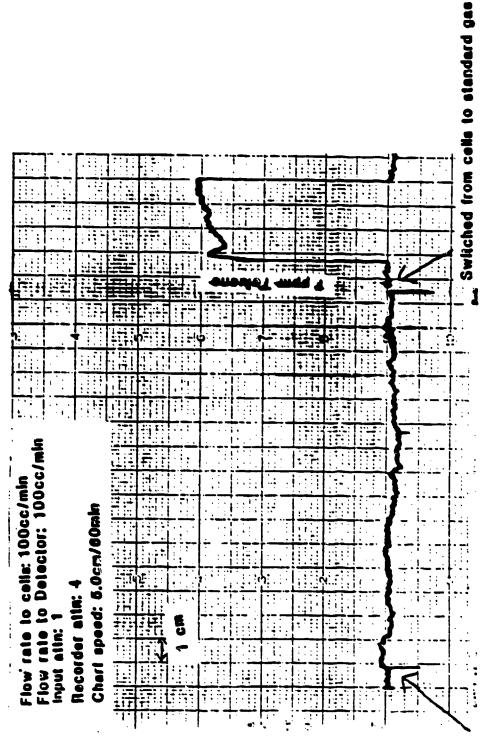
DES	SCRIPTION OF PRODUCT				
1:					
2:	PROTECTIVE MATERIA				
3:	CONDITION BEFORE T	EST: Unused, no vi	sible imperfection	ns	
4:		mfab Corp.			
5:			00	<del></del>	المرافقين بمدير بالتهام مسوم
6:	LOT OR MANUFACTURE NOMINAL THICKNESS:				
/: 8:					
0:	DESCRIPTION: Mate other side.	rial was orange col	ored on one side	and buil	colored on th
TES	ST METHOD				
1.		: Texas Research In			
	ANALYTICAL METHOD:		onization detection	on with a	11.70 eV lat
	TEMPERATURE: 22-25 COLLECTION MEDIUM:		<del></del>		
				<del></del>	
	COLLECTION SYSTEM:		/8		- 400
7	OTHER CONDITIONS: DEVIATIONS FROM AS	TW E723 METUOD. TO	used./Detector To	emperatur	e = 000.
<i>,</i> .	DEVIATIONS FROM AS	IW 1.33 METHOD: 110	M Late to Cells A	ES TOO CC	/m1n.
CRI	LLENGE CHEMICAL	1 :	COMPONENT 2	•	3
		•	4.	:	
1.		,2-Dichloroethyl:	N/A	:	N/A
2		ther :	N/A	:	N/A
	CAS NUMBER(s): 6		N/A	<b>:</b>	N/A
	CONC. (IF MIX) N CHEMICAL SOURCE: K	<u>/A</u> :	N/A N/A	<u>:</u>	N/A N/A
	ST RESULTS				
	DATE TESTED: July				
	NUMBER OF SAMPLES T				
٥.	BREAKTHROUGH TIME:	No breakthrough wa	s observed after	3 hours.	
	MIN DETECTABLE LIMI			· <del></del>	
	STEADY STATE PERMEA SAMPLE THICKNESS: 1				
	SELECTED DATA POINT		<del> · · · · · · · · · · · · · · · · · · </del>		<del></del>
,,		5 N/A			
	TIME : :	CONCENTRATION	: CONCENTRATION	N : CO	NCENTRATION
	2		:	•	
	3.		:	:	
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0	OTUED OBCERVANTONO	<del>-</del>			
٥.	OTHER OBSERVATIONS:				<del></del>
	<del></del>			<del></del> -	
	RCE OF DATA				
Snii					
SOU	•	n by Sylvia Cooper	on July 16. 1986.		

TO THE PARTY OF TH

Chemical Restance Testing of USCG Material with Dichloroethylether

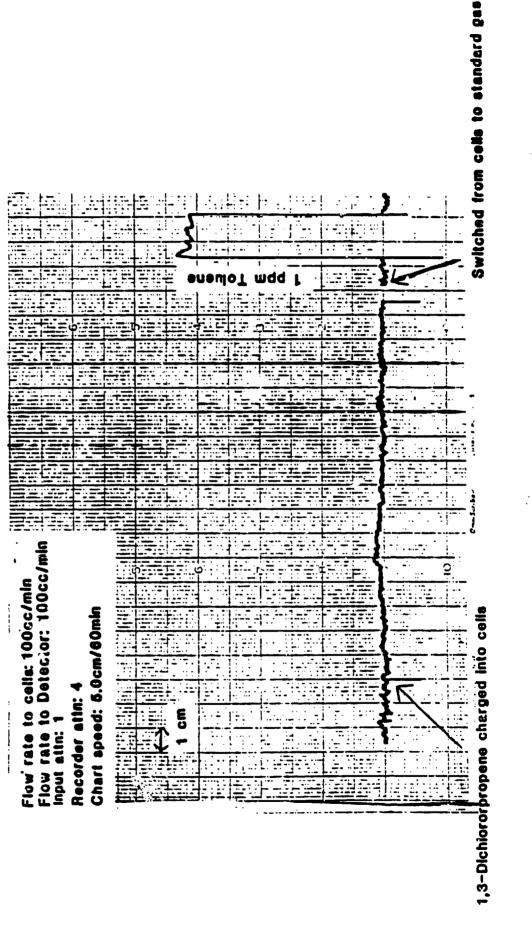


		RIFTION OF PRUDU			
		TYPE: <u>Teflon lam</u> PROTECTIVE MATER			
			TEST: Unused, no vis	ible imperfections	
		MANUFACTURER: C PRODUCT IDENTIFI	nemtab Corp. CATION: Challenge 510	0	
	6:	LOT OR MANUFACTU	RER DATE: N/A		
	7:	NOMINAL THICKNES	S: 15-20 mil		
	8: 1	other side.	terial was orange colo	ored on one side and b	butt colored on the
2.	TEST	METHOD			
	1.	TESTING LABORATO	RY: Texas Research Ins	titute, 9063 Bee Cave	s Road, Austin, TX
		ANALYTICAL METHO TEMPERATURE: 22-	D: Continuous photoio	nization detection wi	th a 11.7 eV lamp.
		COLLECTION MEDIU			
	5.	COLLECTION SYSTE	M: N2		
	6. (	OTHER CONDITIONS	: I inch cells were ASTM F739 METHOD: Flo	used./ Detector Tempe	orature = 60C.
<b>-</b>		LENGE CHEMICAL		COMPONENT 2 :	
3.			1	:	3
		CAS NUMBER(s):	1,2-Dichloropropane:	N/A :	N/A N/A
	3.	CONC. (IF MIX)	N/A :	N/A	N/A
	4.	CHEMICAL SOURCE:	Kodak reagent grade:	N/A :	N/A
	2. NI 3. BI	UMBER OF SAMPLES REAKTHROUGH TIME	: No breakthrough was	observed after 3.1 h	iours
	4. M	IN DETECTABLE LI	MIT31 ppm		
	6. S	AMPLE THICKNESS:	EATION RATE N/A 18-19 mil		
	7. S	ELECTED DATA POI	NTS N/A		
	1	TIME :	CONCENTRATION	: CONCENTRATION :	CONCENTRATION
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	3	•			
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	7 8 9		ıs:		
5.	7 8 9 1 8. 0	THER OBSERVATION	S:	on July 1, 1986	

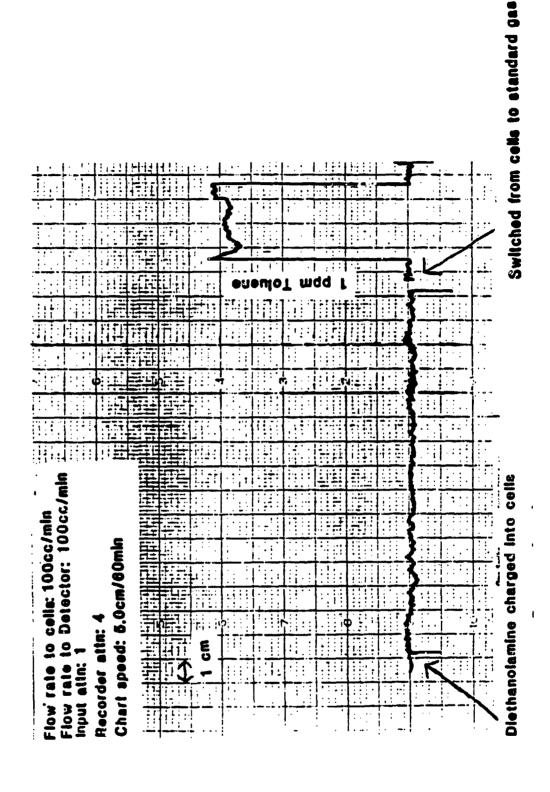


1,2-Dichieropropane charged into cells

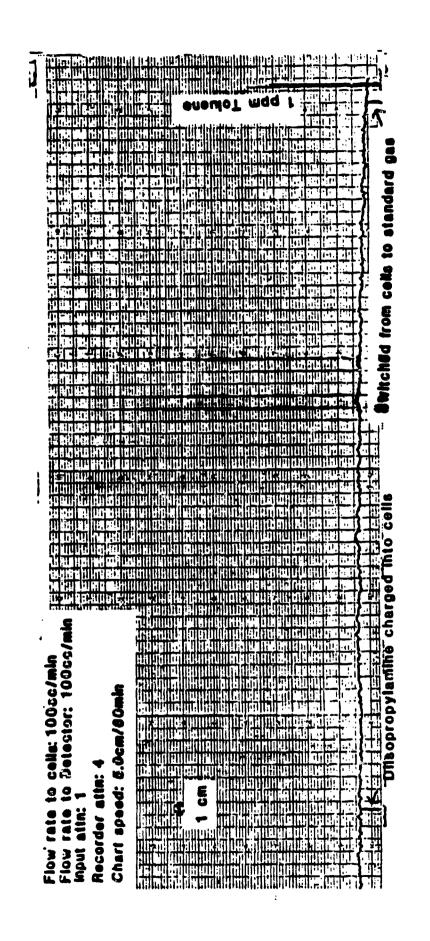
1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.
2.	TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp. 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min.
3.	CHALLENGE CHEMICAL 1 : COMPUNENT 2 : 3
	1. CHEM NAME(s): 1.3-Dichloropropene: N/A N/A  2. CAS NUMBER(s): 542-75-6 N/A N/A  3. CONC. (IF MIX) N/A N/A N/A  4. CHEMICAL SOURCE: Aldrich reagent N/A N/A  grade N/A N/A
	1. DATE TESTED: July 10, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT .17 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
	2
	4.
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	9. : : : : : : : : : : : : : : : : : : :
	8. OTHER OBSERVATIONS:
5.	SOURCE OF DATA Samples were run by Sylvia Cooper on July 10, 1986.



	1: 2: 3:	PROTECT IVE MAT	aminated Nomex ERIAL CODE: 068 RE TEST: Unused no	visible imperfections	
	3: 4:	MANUFACTURER:		VISIDIE IMPERIECTIONS	
	5:	PRODUCT IDENT	FICATION: Challenge	5100	
	6:		TURER DATE: N/A		
	7: 8:	NOMINAL THICKN		colored on one side a	nd buff colored on the
	٠.	other side.	The Control of Control		
2.	TES	ST METHOD			
	1.				Caves Road, Austin, TX
	2. 3.	ANALYTICAL MET TEMPERATURE: 2		tolonization detection	n with a 11.7 eV lamp.
	4.				<del></del>
	5.	COLLECTION SYS	TEM: N2		
	6. 7.	OTHER CONDITION	NS: I inch cells w	ere used./ Detector To Flow rate to cells wa	emperature = 60C. as 100 cc/min.
3.	CHA	LLENGE CHEMICAL	•	: COMPONENT 2	: 3
	. 7	CUEM MANT/A	Dáchtaral amira	• •	1 1 2
		CAS NUMBER(s):	Diethanolamine	: N/A : N/A	. N/A N/A
	3.	CONC. (IF MIX)	N/A	: N/n	N/A
	4.	CHEMICAL SOURC	E:Aldrich reagent	: <b>N</b> /A	: N/A
١.	TFC	T RESULTS	grade	: N/A	:N/A
•	1 23	REJUETS			
		DATE TESTED: J			<del></del>
		NUMBER OF SAMPI		was observed after 3	hours.
		MIN DETECTABLE		### ### ### ### #### #################	
			RMEATION RATE N/A		
		SAMPLE THICKNESS SELECTED DATA F			
		TIME	: CONCENTRATIO	N : CONCENTRATION	: CONCENTRATION
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		4.	•		•
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		9.	•		•
		10			
	8.	OTHER OBSERVAT	IONS:		



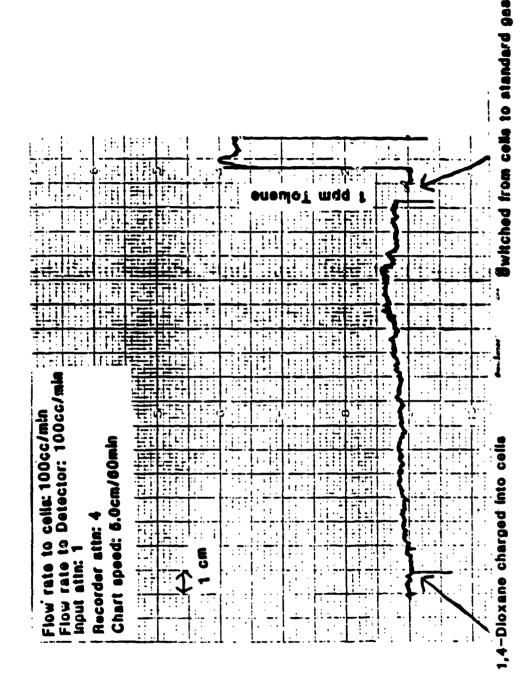
	5: PRODUCT IDENTIFICAT 6: LOT OR MANUFACTURER 7: NOMINAL THICKNESS:	CODE: 068 ST: Unused, no vis fab Corp. ION: Challenge 510 DATE: N/A 15-20 mil	00	buff colored on the
2.	TEST METHOD			
	1. TESTING LABORATORY: 2. ANALYTICAL METHOD: 3. TEMPERATURE: 22-25° 4. COLLECTION MEDIUM: 5. COLLECTION SYSTEM: 6. OTHER CONDITIONS: 7. DEVIATIONS FROM AST	Continuous photoic  N <sub>2</sub> N <sub>2</sub> 2 inch cells were	used. /Detector Tem	ves Road, Austin, TX with a 11.70 eV lamp. perature = 600. 100cc/min
3.	CHALLENGE CHEMICAL	r 1	COMPONENT 2	: 3
•	1. CHEM NAME(s): Dii 2. CAS NUMBER(s): 108 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: ATd gra TEST RESULTS	-18-9 rich reagent	N/A N/A - ん, ム N/A N/A	N/A N/A N/A シ/a
•				
-	1. DATE TESTED: May 20 2. NUMBER OF SAMPLES TE 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIMIT 5. STEADY STATE PERMEAT 6. SAMPLE THICKNESS: 17 7. SELECTED DATA POINTS	STED: Three  No breakthrough was  .39 ppm  ION RATE N/A  -19 mil	observed after 15	hours
•	2. NUMBER OF SAMPLES TE 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIMIT 5. STEADY STATE PERMEAT 6. SAMPLE THICKNESS: 17 7. SELECTED DATA POINTS  TIME:	STED: Three  No breakthrough was  .39 ppm  ION RATE N/A  -19 mil		
•	2. NUMBER OF SAMPLES TE 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIMIT 5. STEADY STATE PERMEAT 6. SAMPLE THICKNESS: 17 7. SELECTED DATA POINTS  TIME 1. 2.	SIED: Three No breakthrough was .39 ppm ION RATE N/A -19 mil N/A		hours
•	2. NUMBER OF SAMPLES TE 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIMIT 5. STEADY STATE PERMEAT 6. SAMPLE THICKNESS: 17 7. SELECTED DATA POINTS  TIME 1. 2. 3.	SIED: Three No breakthrough was .39 ppm ION RATE N/A -19 mil N/A		hours
-	2. NUMBER OF SAMPLES TE 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIMIT 5. STEADY STATE PERMEAT 6. SAMPLE THICKNESS: 17 7. SELECTED DATA POINTS  TIME 1. 2.	SIED: Three No breakthrough was .39 ppm ION RATE N/A -19 mil N/A		hours
-	2. NUMBER OF SAMPLES TE 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIMIT 5. STEADY STATE PERMEAT 6. SAMPLE THICKNESS: 17 7. SELECTED DATA POINTS  TIME 1	SIED: Three No breakthrough was .39 ppm ION RATE N/A -19 mil N/A CONCENTRATION		hours
•	2. NUMBER OF SAMPLES TE 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIMIT 5. STEADY STATE PERMEAT 6. SAMPLE THICKNESS: 17 7. SELECTED DATA POINTS  TIME 1	SIED: Three No breakthrough was .39 ppm ION RATE N/A -19 mil N/A CONCENTRATION		hours
	2. NUMBER OF SAMPLES TE 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIMIT 5. STEADY STATE PERMEAT 6. SAMPLE THICKNESS: 17 7. SELECTED DATA POINTS  TIME 1	SIED: Three No breakthrough was .39 ppm ION RATE N/A -19 mil N/A CONCENTRATION		hours
	2. NUMBER OF SAMPLES TE 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIMIT 5. STEADY STATE PERMEAT 6. SAMPLE THICKNESS: 17 7. SELECTED DATA POINTS  TIME 1	SIED: Three No breakthrough was .39 ppm ION RATE N/A -19 mil N/A CONCENTRATION		hours
	2. NUMBER OF SAMPLES TE 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIMIT 5. STEADY STATE PERMEAT 6. SAMPLE THICKNESS: 17 7. SELECTED DATA POINTS  TIME 1	SIED: Three No breakthrough was .39 ppm ION RATE N/A -19 mil N/A CONCENTRATION	: CONCENTRATION	CONCENTRATION



1.	DESCRIPTION OF PRODUCT EVALUATED		
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no v 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange coother side.		
2.	TEST METHOD		
	1. TESTING LABORATORY: Texas Research I 2. ANALYTICAL METHOD: Continuous photo 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cells were 7. DEVIATIONS FROM ASTM F739 METHOD: F	pionization detection	on with a 10.2 lamp.
3.	CHALLENGE CHEMICAL 1	: COMPONENT 2	3
	1. CHEM NAME(s): Dimethyl Sulfate 2. CAS NUMBER(s): 77-78-01 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: Baker	N/A N/A N/A N/A	N/A N/A N/A N/A
4.	TEST RESULTS	-	:
	1. DATE TESTED: September 21, 1986 . 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT 1.52 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A		
	TIME : CONCENTRATION	: CONCENTRATION	: CONCENTRATION
	2		
	4.		
	6.	:	
	7.	:	
	9	:	
	10	:	
	8. OTHER OBSERVATIONS:		
5.	SOURCE OF DATA Samples were run by Denise McDon	ald on September 21	, 1986.

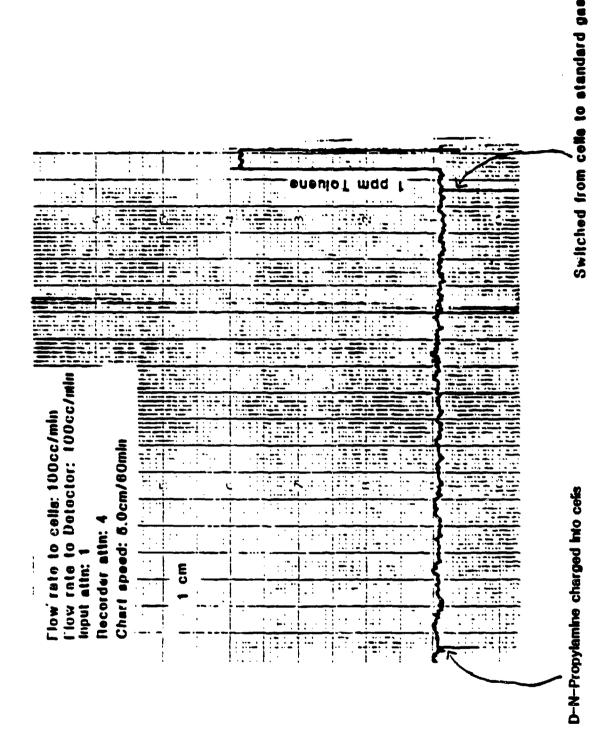
Dimethyl Sulfate charoed into.

1.	DESCRIPTION OF PRODUCT EVALUATED		
	1: TYPE: Teflon laminated Nomex		
	2: PROTECTIVE MATERIAL CODE: 068		
	3: CONDITION BEFORE TEST: <u>Unused</u> , no 4: MANUFACTURER: <u>Chemfab Corp</u> .	visible imperfection	S
	5: PRODUCT IDENTIFICATION: Challenge	5100	
	6: LOT OR MANUFACTURER DATE: N/A	3100	
	7: NOMINAL THICKNESS: 15-20 mil		<del></del>
	8: DESCRIPTION: Material was orange	colored on one side a	nd buff colored on the
	other side.		
2.	TEST METHOD		
	1. TESTING LABORATORY: Texas Research	Institute, 9063 Ree	Caves Road Austin TY
	<ol><li>ANALYTICAL METHOD: Continuous pho</li></ol>	toionization detectio	n with a 11.7 eV Tamp.
	3. TEMPERATURE: 22-25°C		
	4. COLLECTION MEDIUM: N2		
	<ul> <li>COLLECTION SYSTEM: N2</li> <li>OTHER CONDITIONS: 1 inch cells w</li> </ul>	uere used / Detector T	272224
	7. DEVIATIONS FROM ASTM F739 METHOD:	Flow rate to cells w	as 100 cc/min.
3.	CHALLENGE CHEMICAL 1	: COMPONENT 2	•
	1. CHEM NAME(s): 1,4-Dioxane	: :N/A	:N/A
	2. CAS NUMBER(s): 123-91-1	: N/A	N/A
	3. CONC. (IF MIX) N/A	:N/A	:N/A
	4. CHEMICAL SOURCE: J.T. Baker reagent		: N/A
4.	TEST RESULTS	:N/A	_:N/A
	1. DATE TESTED:June 26, 1986		
	2. NUMBER OF SAMPLES TESTED: Three	<del></del>	
	3. BREAKTHROUGH TIME: No breakthrough	was observed after 3	hours.
	4. MIN DETECTABLE LIMIT 1.04 ppm		
	5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 18-19 mil		
	7. SELECTED DATA POINTS N/A		
	N/A		
	TIME : CONCENTRATIO	N : CONCENTRATION	: CONCENTRATION
	1. :	<u> </u>	
	3.	<u>.</u>	•
	4.	•	•
	5	•	
	6	•	:
	7. <u>:</u>	<del>:</del>	<u> </u>
	9.		
	10	<del></del>	
	8. OTHER OBSERVATIONS:		
		<del></del>	
•	COIDSE OF BILL		
5.	SOURCE OF DATA		
	Samples were run by Sylvia Coo	per on June 26, 1986	



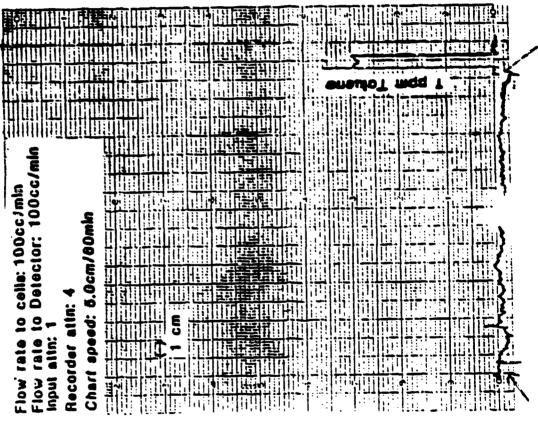
2:		laminated Nomex		
	<del>-</del> - ·	TERIAL CODE: 068		
			no visible imperfections	
		Chemfab Corp.		
		IFICATION: Challe	nge 5100	
		CTURER DATE: N/A		
		NESS: 15-20 mil		buff calored as the
0:	other side.	Material was oran	ge colored on one side and	Buil Colored on the
	Other side.			<del></del>
TEST	r METHOD			
			rch Institute, 9063 Bee Cav	
			photoionization detection a	rith a 11.70 eV lamp
3.	TEMPERATURE:	22-25°C		
	COLLECTION ME			
	COLLECTION SY			
			s were used. Detector Temp	
7.	DEVIATIONS FR	OM ASTM F739 METHO	D: Flow rate to cells was	100 cc/min.
CHAI	LLENGE CHEMICA	L 1	: .COMPONENT 2	3
,	CUTY VANE (e)	: Dipropylamine	: <b>T</b> /Å.	N/A
2.	CAS NUMBER(s)	107-10-8	N/A	N/A
	CONC. (IF MIX		N/A	N/A
	-	CE:Aldrich reagent		N/A
• •		grade	N/A	N/A
TEST	T RESULTS			,
		July 18, 1986		
1. I	DATE TESTED:	,,		
		LES TESTED: Three		
2. N	NUMBER OF SAMP	LES TESTED: Three	ugh was observed after 3.0	hours.
2. N 3. I 4. N	NUMBER OF SANT BREAKTHROUGH T MIN DETECTABLE	LES TESTED: Three IME: No breakthro LIMIT .22 ppm	ugh was observed after 3.4	hours
2. N 3. I 4. N 5. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/	ugh was observed after 3.4	hours.
2. N 3. I 4. N 5. S 6. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/ SS: 18-19 mil	ugh was observed after 3.4	hours.
2. N 3. I 4. N 5. S 6. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/ SS: 18-19 mil	ugh was observed after 3.4	hours.
2. N 3. I 4. N 5. S 6. S 7. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/ SS: 18-19 mil	ugh was observed after 3.0	
2. N 3. I 4. N 5. S 7. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA TIME	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/ SS: 18-19 mil POINTS N/A : CONCENTRA	ugh was observed after 3.0	
2. N 3. I 4. N 5. S 6. S 7. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA  TIME 1.	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/ SS: 18-19 mil POINTS N/A	ugh was observed after 3.0	
2. N 3. I 4. N 5. S 6. S 7. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3.	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/ SS: 18-19 mil POINTS N/A : CONCENTRA	ugh was observed after 3.0	
2. N 3. I 4. N 5. S 6. S 7. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3.	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/ SS: 18-19 mil POINTS N/A : CONCENTRA	ugh was observed after 3.0	
2. N 3. I 4. N 5. S 6. S 7. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4.	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/ SS: 18-19 mil POINTS N/A : CONCENTRA	ugh was observed after 3.0	
2. N 3. I 4. N 5. S 6. S 7. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA  TIME 1. 2. 3. 4. 5.	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/ SS: 18-19 mil POINTS N/A : CONCENTRA	ugh was observed after 3.0	
2. N 3. I 4. N 5. S 6. S 7. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA  TIME 1. 2. 3. 4. 5.	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/ SS: 18-19 mil POINTS N/A : CONCENTRA	ugh was observed after 3.0	
2. N 3. I 4. N 5. S 6. S 7. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA  TIME 1. 2. 3. 4. 5. 6. 7.	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/ SS: 18-19 mil POINTS N/A : CONCENTRA	ugh was observed after 3.0	
2. N 3. I 4. N 5. S 6. S 7. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA  TIME 1. 2. 3. 4. 5.	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/ SS: 18-19 mil POINTS N/A : CONCENTRA	ugh was observed after 3.0	
2. N 3. I 4. N 5. S 6. S 7. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/ SS: 18-19 mil POINTS N/A  : CONCENTRA : : : : : : : : : : : : : : : : : : :	ugh was observed after 3.0	
2. N 3. I 4. N 5. S 6. S 7. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8.	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/ SS: 18-19 mil POINTS N/A  : CONCENTRA : : : : : : : : : : : : : : : : : : :	ugh was observed after 3.0	
2. N 3. I 4. N 5. S 6. S 7. S	NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	LES TESTED: Three IME: No breakthro LIMIT .22 ppm ERMEATION RATE N/ SS: 18-19 mil POINTS N/A  : CONCENTRA : : : : : : : : : : : : : : : : : : :	ugh was observed after 3.0	

Chemical Resistance Testing of USCG Material with Dipropylamine



1.	DESCRIPTION OF PRODUCT EASTONIED	
	1: TYPE: Teflon laminated Nomex	•
	2: PROTECTIVE MATERIAL CODE: 068	
		no visible imperfections
		no visible imperiections
	5: PRODUCT IDENTIFICATION: Challen	de 2100
	6: LOT OR MANUFACTURER DATE: N/A	
	7: NOMINAL THICKNESS: 15-20 mil	
		e colored on one side and buff colored on the
	other side.	
_		
2.	TEST METHOD	•
	TECTING LABORATORY To a December 1	
	1. TESTING LABORATORY: Texas Resear	ch Institute, 9063 Bee Caves Road, Austin, TX
		hutoionization detection with a 11.70 eV lamp.
	3. TEMPERATURE: 22-25°C	والمراج المراجع والمراجع
	4. COLLECTION MEDIUM: No	
	5. COLLECTION SYSTEM: N2	
	6. OTHER CONDITIONS: I inch cells we	ere used. /Detector Temperature = 60C.
	7. DEVIATIONS FROM ASTM F739 METHOD	: Flow rate to cells was 1.0cc/m <sup>2</sup>
_	C1141 1 PM C	
3.	CHALLENGE CHEMICAL 1	: COMPONENT 2 : 3
	1 PUPM NAME (a) - Paiaklamakududa	; i
	1. CHEM NAME(s): Epichlorohydrin	: N/A : N/A
	2. CAS NUMBER(s): 106-89-8	: N/A : N/A
	3. CONC. (IF MIX) N/A	: N/A : N/A
	4. CHEMICAL SOURCE: Fisher	: N/A : N/A
	Reagent Grade	: N/A : N/A
4.	TEST RESULTS	
		•
	1. DATE TESTED: June 4, 1986	
	2. NUMBER OF SAMPLES TESTED: Three	
	3. BREAKTHROUGH TIME: No breakthroug	h was observed after three hours.
	4. MIN DETECTABLE LIMIT 0.75 ppm	
	5. STEADY STATE PERMEATION RATE N/A	
	6. SAMPLE THICKNESS: 18-20 mil	
	7. SELECTED DATA POINTS N/A	
	TIME : CONCENTRAT	ION : CONCENTRATION : CONCENTRATION
	1	<u> </u>
	2.	
	3, <u>:</u> :	
	4.	
	5.	
	6, :	
	7.	
	8. :	
	9.	:
	10.	
	8. OTHER OBSERVATIONS:	
	villed de delittil falle i	
	<del></del>	
5.	SOURCE OF DATA	
- •	Samples were run by Sylvia	R. Cooper on June 4. 1986
	Samples were run by 031418	114 AAAA1 AII AAIIA 13 8000

# Chemical Resistance Testing of USCG Material with Epichlorohydrin



ipichlorohydrin charged into cells

1: TYPE: Teflon laminated Namex PROTECTIVE NATERIAL CODE: 068 1: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER DATE: N/A 1: MANUFACTURER DATE: N/A 1: NOMINAL THICKNESS: 15-20 mil 1: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.  TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION MEDIUM: N <sub>2</sub> 6. OTHER CONDITIONS: 2 inch cells were used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASTN F739 METHOD: Flow text to cells was 100 cc/min.  CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Ethion 4 : N/A : N/A 2. CAS NUMBER(s): N/A : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A 7. DATE TESTED: October 12, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours. 4. MIN DETECTABLE LIMIT. U3 ppm 5. STEADY STATE PERMEATION RATE N/A 5. CANDEL THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1		SCRIPTION OF PROD	OCI ETALONIED			
3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOWINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.  TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lam 3. TEMPERATURE: 22-25*C 4. COLLECTION SYSTEM: N/2 5. COLLECTION SYSTEM: N/2 6. OTHER CONDITIONS: Z inch cells were used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F/38 TETMEN: Flaw YEAR 25 DERIS was 100 EC/min.  CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Ethion 4 : N/A : N/A 2. CAS MUMBER (s): N/A : N/A : N/A 3. CONC. (If MIX.) N/A : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A : N/A 5. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. SELECTED DATA POINTS N/A 5. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A 5. SOURCE OF DATA  SOURCE OF DATA						
### MANUFACTURER: Chemfab Corp. PRODUCT 10ENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: MCMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.  TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10-20 eV lamp 3. TEMPERATURE: 22-25 t 4. COLLECTION MEDIUM: No. 5. COLLECTION MEDIUM: No. 6. OTHER CONDITIONS: Z inch Cells were used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F/30 METHOD: Flow value to sells was 100 EE/min.  CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Ethion 4 : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A 5. SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours. 4. MIN DETECTABLE LIMIT .03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :						
5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.  TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp 3. TEMPERATURE: 22-25 °C 4. COLLECTION SYSTEM: N/O 5. COLLECTION SYSTEM: N/O 6. OTHER CONDITIONS: 2 inch cells were used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F/39 TETHOD: Flow TOTAL TO SELIS WAS 100 CC/min.  CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Ethion 4 : N/A : N/A 2. CAS MUMBER(s): N/A : N/A : N/A 3. CONC. (If MIX) N/A : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLES TESTED: Three 1. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours. 4. MIN DETECTABLE LINIT, 0/3 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1				isible impertection	ns	
6: LOT OR MANUFACTURER DATE: N/A 7: NOCHNAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.  TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp 3. TEMPERATURE: 22-25 T 4. COLLECTION MEDIUM: N2 5. COLLECTION MEDIUM: N2 6. OTHER CONDITIONS: 2 Inch Cells were used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F/39 TETHOD: Flav Tyte to Dells was 100 EC/min.  CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Ethion 4 : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A : N/A 7. DATE TESTED: October 12, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours. 4. MIN DETECTABLE LIMIT .03 ppm 5. STEADY STATE PERNEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : 5. : : : : : : : : : : : 7. : : : : : : : : : : : : 8. : : : : : : : : : : : : : : : : 9. : : : : : : : : : : : : : : : : : : :				100		
7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.  TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp 3. TEMPERATURE: 22-25 t 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: Z Inch cells were used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F/38 TETMID: Flav Table to Emils was 100 Ec/min.  CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Ethiom 4 : N/A : N/A 2. CAS NUMBER(s): N/A : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A  TEST RESULTS 1. DATE TESTED: October 12, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours. 4. MIN DETECTABLE LIMIT. 03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :				100		<del></del>
BESCRIPTION: Material was orange colored on one side and buff colored on the other side.  TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: No 5. COLLECTION MEDIUM: No 6. OTHER CONDITIONS: Z inch cells were used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F/39 METHOD: Flow value to cells was 100 cc/min.  CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3  1. CHEM NAME(s): Ethion 4 : N/A : N/						
TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp 3. TEMPERATURE: 22.25 °C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 2 Inch Cells were used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F/39 WEINDO: Flow was 100 EC/min.  CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3  1. CHEM NAME(s): Ethion 4 : N/A : N/A 2. CAS NUMBER(s): N/A : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A 7. NA 7. SEST RESULTS  1. DATE TESTED: October 12, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours. 4. MIN DETECTABLE LIMIT .03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :				lored on one side	and buf	f colored on the
1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp 3. TEMPERATURE: 22-25 C 4. COLLECTION BOTUN: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 2 inch cells were used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASIN F7.39 METHOD: FISH YER TO DEVIS WAS 100 EC/min.  CHALLENGE CHEMICAL 1: COMPONENT 2: 3 1. CHEM NAME(s): Ethion 4: N/A: N/A 2. CAS NUMBER(s): N/A: N/A: N/A: N/A 3. CONC. (IF MIX) N/A: N/A: N/A: N/A 4. CHEMICAL SOURCE:FMC Corp.: N/A: N/A: N/A 7. TIME: COLOBER 12, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours. 4. MIN DETECTABLE LIMIT. JO3 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS: N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :		other side.				
2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: No 5. COLLECTION SYSTEM: No 6. OTHER CONDITIONS: Z inch cells were used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F/39 TEMBLE: Flow write to tells was 100 te/min.  CHALLENGE CHEMICAL 1: COMPONENT 2: 3 1. CHEM NAME(s): Ethion 4: N/A: N/A: N/A 2. CAS NUMBER(s): N/A: N/A: N/A: N/A 3. CONC. (IF MIX) N/A: N/A: N/A: N/A 4. CHEMICAL SOURCE:FMC Corp.: N/A: N/A: N/A TEST RESULTS 1. DATE TESTED: October 12, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours. 4. NIN DETECTABLE LIMIT. 03 ppm 5. STEADY STATE PERMEATION RATE: N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS: N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :	. TE	EST METHOD_				
2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: No 5. COLLECTION SYSTEM: No 6. OTHER CONDITIONS: Z inch cells were used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F/39 TEMBLE: Flow write to tells was 100 te/min.  CHALLENGE CHEMICAL 1: COMPONENT 2: 3 1. CHEM NAME(s): Ethion 4: N/A: N/A: N/A 2. CAS NUMBER(s): N/A: N/A: N/A: N/A 3. CONC. (IF MIX) N/A: N/A: N/A: N/A 4. CHEMICAL SOURCE:FMC Corp.: N/A: N/A: N/A TEST RESULTS 1. DATE TESTED: October 12, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours. 4. NIN DETECTABLE LIMIT. 03 ppm 5. STEADY STATE PERMEATION RATE: N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS: N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :		TESTING LABORAT	ORY: Texas Research I	nstitute, 9063 Bee	Caves	Road, Austin, TX
4. COLLECTION MEDIUM: No   5. COLLECTION SYSTEM: No   6. OTHER CONDITIONS: 2 Inch cells were used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASTN F/39 TETHIND: Flow Tate to cells was 100 cc/min.  CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3  1. CHEM NAME(s): Ethion 4 : N/A :		, "ANALYTICAL METH	IOD: Continuous photo	ionization detection	on with	a 10.20 eV lamp.
5. COLLECTION SYSTEM: No 6. OTHER CONDITIONS: 2 Inch cells were used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASIN F/39 METHOD: Flow rate to cells was 100 cc/min.  CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3  1. CHEM NAME(s): Ethion 4 : N/A : N/A : N/A 2. CAS NUMBER(s): N/A : N/A : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A : N/A  TEST RESULTS  1. DATE TESTED: October 12, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours. 4. MIN DETECTABLE LINIT .03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :						
6. OTHER CONDITIONS: 2 Inch cells were used./ Detector Temperature = 100C. 7. DEVIATIONS FROM ASTM F/39 METHOD: Flow rate to cells was 100 cc/min.  CHALLENGE CHEMICAL						
7. DEVIATIONS FROM ASTN F739 WETHOD: Flow trite to cells was 100 cc/min.  CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3  1. CHEM NAME(s): Ethion 4 : N/A : N/A : N/A  2. CAS NUMBER(s): N/A : N/A : N/A : N/A  3. CONC. (IF MIX) N/A : N/A : N/A : N/A  4. CHEMICAL SOURCE: FMC Corp. : N/A : N/A : N/A  TEST RESULTS  1. DATE TESTED: October 12, 1986  2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours.  4. MIN DETECTABLE LIMIT 1.03 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 19-20 mil  7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION  1. : : : : : : : : : : : : : : : : : : :	5.	COLLECTION SYST	EM: N2			. 1000
CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3  1. CHEM NAME(s): Ethion 4 : N/A : N/A 2. CAS NUMBER(s): N/A : N/A : N/A : N/A 3. CONC. (IF MIX) N/A : N/A : N/A : N/A 4. CHEMICAL SOURCE:FMC Corp. : N/A : N/A : N/A  TEST RESULTS  1. DATE TESTED: October 12, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours. 4. MIN DETECTABLE LIMIT .03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :	0.	. UTHER CONVILLOR	is: 2 inch cells wer	e used. / Detector	empera	ture = 100C.
1. CHEM NAME(s): Ethion 4 : N/A : N/	•	PEATHITOM END	I MO IN THE INCHES T	THE THE CO CEITS	100	
2. CAS NUMBER(s): N/A	CH	HALLENGE CHEMICAL	1	: COMPONENT 2	:	3
3. CONC. (IF MIX) N/A N/A N/A N/A N/A  4. CHEMICAL SOURCE: FMC Corp. N/A N/A N/A  TEST RESULTS  1. DATE TESTED: October 12, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours.  4. MIN DETECTABLE LIMIT .03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION  1. : : : : : : : : : : : : : : : : : : :				:N/A	:	
4. CHEMICAL SOURCE: FMC Corp. : N/A : N/A  TEST RESULTS  1. DATE TESTED: October 12, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours. 4. MIN DETECTABLE LIMIT .03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : :					$\equiv$	
TEST RESULTS  1. DATE TESTED: October 12, 1986  2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours.  4. MIN DETECTABLE LIMIT .03 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 19-20 mil  7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:  2. : : : : : : : : : : : : : : : : : : :	_				:	
1. DATE TESTED: October 12, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 4.84 hours. 4. MIN DETECTABLE LIMIT .03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :	4.	. CHEMICAL SOURCE	:FMC Corp.	:N/A	;	N/A
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2.			: CONCENTRATION	: CONCENTRATIO	N :	CONCENTRATION
4. 5. 6. 7. 8. 9. 10.  8. OTHER OBSERVATIONS:		2.				
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6. 7. 8. 9. 10.  8. OTHER OBSERVATIONS:					<del></del>	
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9		<b>N</b>	•		•	
9		7.	·	•	•	
8. OTHER OBSERVATIONS: : : : : : : : : : : : : : : : : : :		7.			-:-	
SOURCE OF DATA		7. 8.				
		7. 8. 9.				
	8.	7. 8. 9. 10.	in the second se			
	8.	7. 8. 9. 10.	: : : : : : : : : : : : : : : : : : :			
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		7. 8. 9. 10. OTHER OBSERVATION		ald on October 12	1086	

Chemical Pristance Testing of USCG Material with Ethion

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Ethlon charged into cells

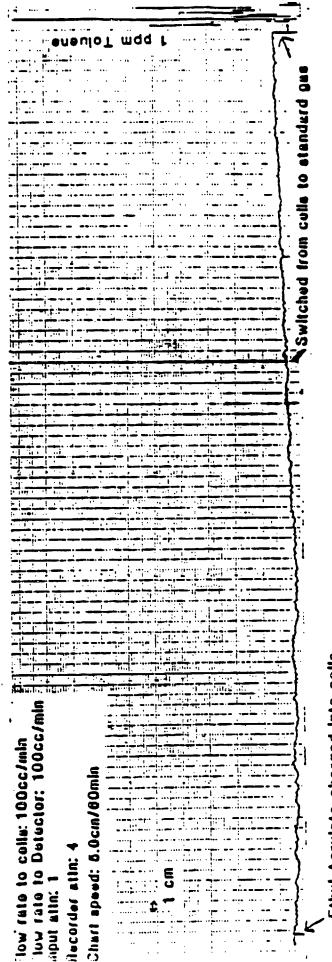
Switched from celia to standard gas

(-12

	DESCRIPTION OF PRODUCT EVALUATED		
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no v 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange co other side.		
	TEST METHOD		
	1. TESTING LABORATORY: Texas Research I 2. ANALYTICAL METHOD: Continuous photo 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cells wer 7. DEVIATIONS FROM ASTM F739 METHOD: F	ionization detection e used./ Detector Te	emperature = 600.
•	CHALLENGE CHEMICAL 1	COMPONENT 2	: 3
	11. CHEM NAME(s): Ethyl Actuate  12. CAS NUMBER(s): 141-78-6  3. CONC. (IF MIX) N/A  4. CHEMICAL SOURCE: Fisher reagent grade	N/A N/A N/A N/A	N/A N/A N/A N/A
	TEST RESULTS  1. DATE TESTED: June 30, 1986		v t
	2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No Breakthrough w 4. MIN DETECTABLE LIMIT .49 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A	as observed after 3.	.1 hours
	2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No Breakthrough w  4. MIN DETECTABLE LIMIT .49 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 18-19 mil  7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION	as observed after 3.  : CONCENTRATION	
	2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No Breakthrough w  4. MIN DETECTABLE LIMIT .49 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 18-19 mil  7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. :  2. :		
	2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No Breakthrough w  4. MIN DETECTABLE LIMIT .49 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 18-19 mil  7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1.		
	2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No Breakthrough w  4. MIN DETECTABLE LIMIT .49 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 18-19 mil  7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. :		
	2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No Breakthrough w  4. MIN DETECTABLE LIMIT .49 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 18-19 mil  7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. :  2. :		
	2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No Breakthrough w  4. MIN DETECTABLE LIMIT .49 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 18-19 mil  7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :		
	2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No Breakthrough w  4. MIN DETECTABLE LIMIT .49 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 18-19 mil  7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :		
	2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No Breakthrough w  4. MIN DETECTABLE LIMIT .49 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 18-19 mil  7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :		

1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.
2.	TEST METHOD .
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 2 inch cells were used. /Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min.
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. CHEM NAME(s): Ethyl Acrylate : N/A : N/A  2. CAS NUMBER(s): 140-88-5 : N/A : N/A  3. CONC. (IF MIX): N/A : N/A : N/A  4. CHEMICAL SOURCE: Aldrich reagent : N/A : N/A : N/A : N/A : N/A
4.	TEST RESULTS
	1. DATE TESTED: May 27, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 17 hours. 4. MIN DETECTABLE LIMIT 1.72 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 18-20 mil. 7. SELECTED DAT. POINTS N/A
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1.
	2
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	8. : : : : : : : : : : : : : : : : : : :
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	8. OTHER OBSERVATIONS:
5.	SOURCE OF DATA Samples were run by Sylvia Cooper on May 27, 1986

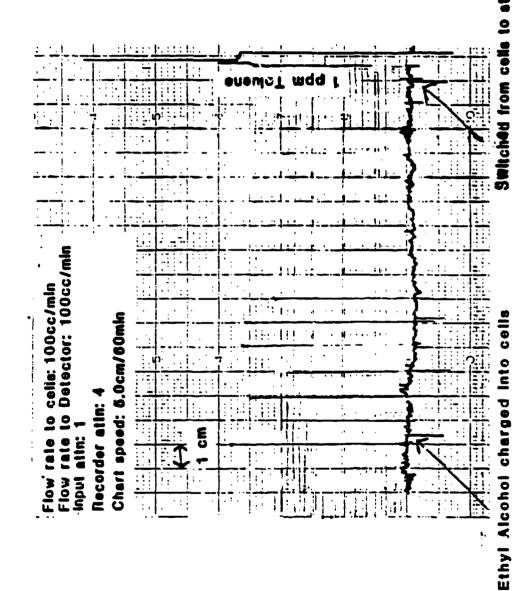
### Chemical Resistance Testing of USCG Material with Ethyl Acrylate



Ethyl Acrylato charged into colls

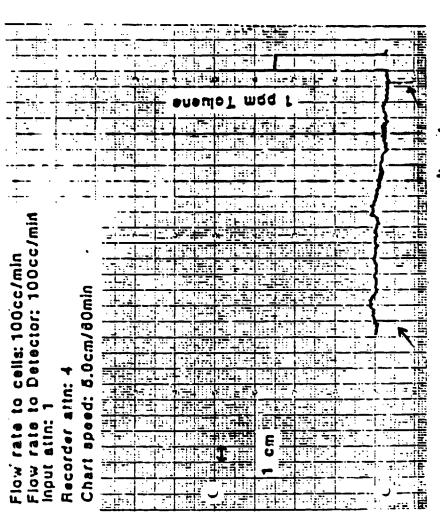
. u	ESCRIPTION OF P	ROUGET ETALUAT				
1	: TYPE: Teflor	laminated Nom	ex			
2		ATERIAL CODE:				
3		FORE TEST: Un		le imperfecti	ons	
4		: Chemfab Cor				
5		TIFICATION: C				
	: LOT OR MANUF					·
	: NOMINAL THIC					
8	<ul><li>DESCRIPTION: other side.</li></ul>	Material was	orange colore	d on one side	and buf	f colored on the
. T	EST METHOD					
1	. TESTING LABO	RATORY: Texas	Research Insti	tute, 9063 Be	e Caves i	Road, Austin, TX
2	. ANALYTICAL M	ETHOD: Contin	uous photoioni	zation detect	ion with	a 11.70 eV lamp.
3						
4.						
5						
	. OTHER CONDIT	IONS: 1 inch c	ells were used	. /Detector Te	<u>emperatu</u>	re = 60C.
7	. DEVIATIONS F	ROM ASTM F739	METHOU: Flow r	ate to cells	was luuc	c/min.
. C	HALLENGE CHEMIC	AL 1	• 1	COMPONENT 2	:	3
1.	L CHEM NAME (s)	: Ethyl Alco	hol :	N/A	:	N/A
2	. CAS NUMBER (S	s): <del>64-17-5</del>	-	N/A	·	N/A
	. CONC. (IF MI	X) N/A	:	N/A	:	N/A
4	. CHEMICAL SOU	RCE: Aldrich re	agent :	N/A		N/A
. TI	EST RESULTS	grade		N/A	;	N/A
2 3 4 5 6	DATE TESTED: NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA	PLES TESTED: T TIME: No break E LIMIT 2.86 PERMEATION RAT IESS: 18-19 mil	through was ob	served after	three no	urs.
	TIME 1.	: CONC	ENTRATION :	CO NCENTRATI	ON :	CONCENTRATION
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8	. OTHER OBSERVA	TIONS:				
. S(	DURCE OF DATA					
	<u>Samples</u> w	ere run by Syl	via R. Cooper	<u>on June 20, 1</u>	986.	

Chemical Resistance Testing of USCG Material with Ethyl Alcohol



. DE	SCRIPTION OF PROD	OCT ETAL UNIED		
1: 2:				
3:	CONDITION BEFOR	E TEST: Unused, no	visible imperfection	ons
4:	MANUFACTURER:	Chemfab Corp.		
5:	PRODUCT IDENTIF	ICATION: Challenge	5100	
o: 7:	LOT OR MANUFACT			
8:		laterial was buff co	ored.	
٠.				
. TE	ST METHOD			
1.	TESTING LABORAT	ORY: Texas Research	Institute, 9063 Bee	Caves Road, Austin, TX
۷٠	TEMPERATURE: 22	OU: Continuous phot	tolonization detecti	on with a 11.7 eV lamp.
4.				
5.	COLLECTION SYST	EM: No		
6.	OTHER CONDITION	S: 2 inch cells wer	re used. / Detector T	emperature = 60C.
7.	DEVIATIONS FROM	ASTM F739 METHOD:	Flow rate to cells	was 100cc/mil.
. CH	ALLENGE CHEMICAL	1	: COMPONENT 2	: 3
1.	CHEM NAME(s):	Ethylamine	: N/A	. N/A
	CAS NUMBER(s):		N/A	N/A
3.		70% in water	: N/A	N/A
4.	CHEMICAL SOURCE	: Aldrich reagent	: N/A	: N/A
TE	ST RESULTS	grade	: N/A	:N/A
2. 3. 4. 5.	MIN DETECTABLE L	S TESTED: Three E: No breakthrough IMIT 0.74 ppm. MEATION RATE N/A : 17-19 mil	was observed after	3 hours.
	TIME 1.	: CONCENTRATION	CONCENTRATIO	N : CONCENTRATION
	2.	:	•	:
	3.	:		:
	4.	<u>:</u>		
	5.	•		
	<del>7</del> .	:		<u> </u>
	8.	•		•
	9.	;	•	<u>:</u>
	10.	:		
_	ATUER ADARTHATIA	NC .		
8.	OTHER OBSERVATIO	N2 '		
SO	URCE OF DATA			
30		run by Sylvia Coope	AP ON MAY 15 1GGK	
	3 gmb ( E2 MELE	Tun by Sylvia Coope	El Oli May 15, 1900.	

### Chernical Resistance Testing of USCG Material with Ethylamine



Ethylamine charged into cells

Switched from cells to standard gas

4.00		CODUCT EVALUATED		
1:		laminated Nomex		
2:		TERIAL CODE: 068		
3:		ORE TEST: Unused, no	visible imperfections	
4:	MANUFACT URER:	Chemfab Corp.		
5:	PRODUCT IDENT	IFICATION: Challenge	5100	
	LOT OR MANUFA	ACTURER DATE: N/A		
7:	NOMINAL THICH	CNESS: 15-20 mil		
8:			colored on one side and	buff colored on the
•	other side.			
TES	ST METHOD			
1.	TESTING LABOR	RATORY: Texas Research	Institute, 9063 Bee Cav	es Road, Austin, TX
			oionization detection w	
	TEMPERATURE:			
	COLLECTION ME			
	COLLECTION SY			
6.	OTHER CONDIT	ICNS - I inch cells wer	e used./ Detector Tempe	rature = 600.
7.	DEVIATIONS F	ION ASTA FASO HETHOD:	Flow rate to cells was	100cc/min.
CHA	ALLENGE CHEMICA	<u>1</u>	: COMPONENT 2 :	3
1.	CHEM NAME (s)	: Ethyl Senzene	<b>W/</b> A	N/A
2.	CAS NUMBER(s)	): 100-41-4	: N/A :	N/A
	CONC. (IF MI)		: N/A :	N/A
4.	CHEMICAL SOUP	CE:Aldrich reagent	: N/A :	N/A
		grade	: N/A :	N/A
2. 3. 4. 5. 6.	BREAKTHROUGH 1 MIN DETECTABLE	PLES TESTED: Three TIME: No breakthrough LIMIT.14 ppm PERMEATION RATE N/A SS: 19 mil	was observed after 3 ho	urs.
	TIME 1.	: CONCENTRATION	: CONCENTRATION :	CO NCENTRATION
	2.			
	3.			
	<u>*</u>			
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	/·		::	
	8.		:	
	9.		<u></u> -	
	10	•	::	
8.	OTHER OBSERVAT	TIONS:		
- <b>-</b>				

## Chemical Resistance Testing of USCG Material with Ethyl Benzene

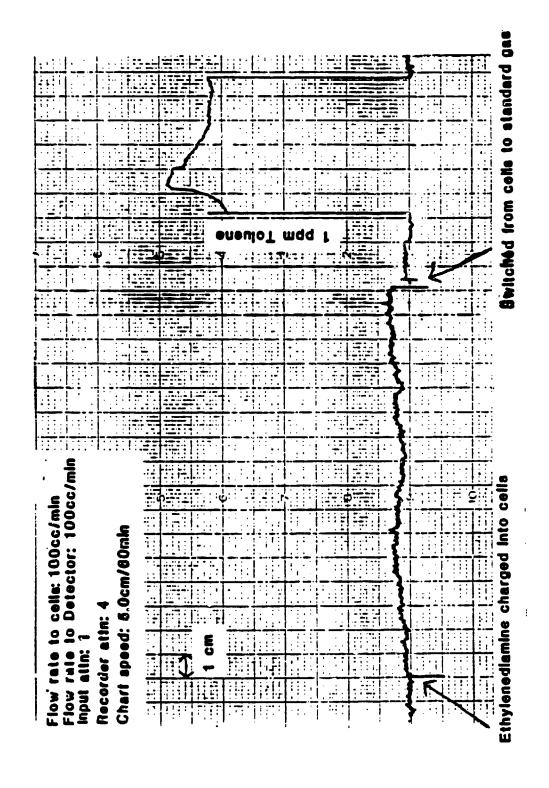
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Cells: 100cc/min  Detector: 100cc  4  6.0cm/80min  1 cm	t. to live hitte him had been been and	
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		C-135 i

1.	DESCRIPTION OF PRODUCT EVALUATED
	1. TVDE. Tofler laminated Nemov
	1: TYPE: Teflon laminated Nomex 2: PRUTECTIVE MATERIAL CODE: 068
	3: CONDITION BEFORE TEST: Unused, no visible imperfections
	4: MANUFACTURER: Chemfab Corp.
	5: PRODUCT IDENTIFICATION: Challenge 5100
	6: LOT OR MANUFACTURER DATE: N/A
	7: NOMINAL THICKNESS: 15-20 mil
	8: DESCRIPTION: Material was orange colored on one side and buff colored on the
	other side.
_	
2.	TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Gas Chromatography
	3. TEMPERATURE: Ambient
	4. COLLECTION MEDIUM: Charcoal
	5. COLLECTION SYSTEM: Charcoal
	6. OTHER CONDITIONS: One inch cells were used.
	7. DEVIATIONS FROM ASTM F739 METHOD:
-	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. CHEM NAME(s): Ethylene Cyanohdrin: N/A : N/A
	2. CAS NUMBER(s): 109-78-4 : N/A : N/A
	3. CONC. (IF MIX) N/A : N/A
	4. CHEMICAL SOURCE: Aldrich reagent : N/A : N/A
	grade : N/A : N/A
	FT RESULTS
	• • • • • • • • • • • • • • • • • • • •
	1. DATE TESTED: October 9,1986
	2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: N/A
	4. MIN DETECTABLE LIMIT 0.4 ppm
	5. STEADY STATE PERMEATION RATE N/A
	6. SAMPLE THICKNESS: 19-20 mils
	7. SELECTED DATA POINTS Cells 1,2, and 3 at end of three hour test.
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
	1. 3 hours : <0.4 ppm : <0.4 ppm : <0.4 ppm
.•	2. : : : : : : : : : : : : : : : : : : :
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	6. ————————————————————————————————————
	7. ————————————————————————————————————
	8.
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	10. : :
	8. OTHER OBSERVATIONS: 3 hour samples were collected for 50 minutes for a total
	volume of 10 liters.
<b>5</b> 。	SOURCE OF BATA
J,	SOURCE OF DATA  Samples were run by Denise McDenald on October 9, 1986
	Samples were run by Denise McDonald on October 9, 1986.

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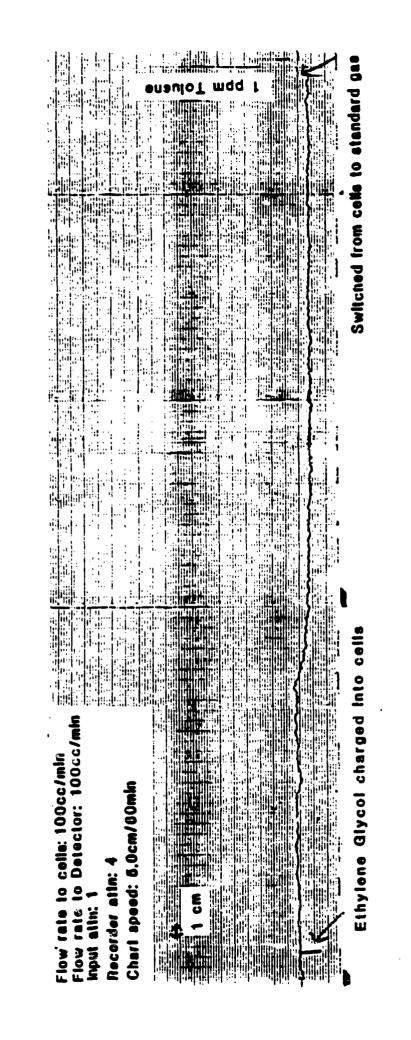
1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex
	2: PROTECTIVE MATERIAL CODE: 068
	3: CONDITION BEFORE TEST: Unused, no visible imperfections
	4: MANUFACTURER: Chemfab Corp.
	5: PRODUCT IDENTIFICATION: Challenge 5100
	6: LOT OR MANUFACTURER DATE: N/A
	7: NOMINAL THICKNESS: 15-20 mil
	8: DESCRIPTION: Material was orange colored on one side and buff colored on the
	other side.
2.	TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp.
	3. TEMPERATURE: 22-25°C
	4. COLLECTION MEDIUM: N2
	5. COLLECTION SYSTEM: No
	6. OTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 60C.  J. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100cc/min.
	J_ DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100cc/min.
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. THEM WAME(s): Ethylenediamine : N/A : N/A
	2. CAS NUMBER(s): 107-15-3 : N/A : N/A
	3. CONC. (IF MIX) N/A : N/A : N/A
	4. CHEMICAL SOURCE: Aldrich reagent : N/A : N/A
	grade : N/A : N/A
4.	TEST RESULTS
	1. DATE TESTED: June 24, 1986
	2. NUMBER OF SAMPLES TESTED: Three
	3. BREAKTHROUGH TIME: No breakthrough was observed after 3.2 hours.
	4. MIN DETECTABLE LIMIT 2.78 ppm
	5. STEADY STATE PERMEATION RATE N/A
	6. SAMPLE THICKNESS: 13-19 mil
	7. SELECTED DATA POINTS N/A
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION :
	<del>2.</del> ————————————————————————————————————
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	10.
	8. OTHER OBSERVATIONS:
	COURCE OF DATA
5.	SOURCE OF DATA
	Samples were run by Sylvia Cooper on June 24, 1986.

# Chemical Resistance Testing of USCG Material with Ethylenediamine



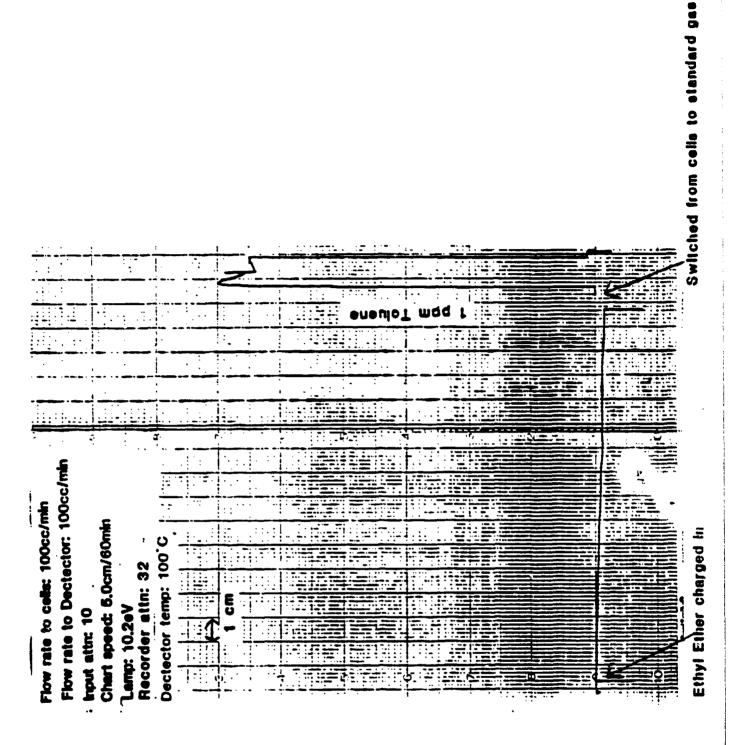
1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.
2.	TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100cc/min.
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. CHEM NAME(s): Ethylene Slycol N/A N/A  2. CAS NUMBER(s): 107-21-1 N/A N/A  3. CONC. (IF MIX) N/A N/A N/A  4. CHEMICAL SOURCE: Baker reagent grade: N/A N/A
4.	TEST RESULTS
	1. DATE TESTED: June 17-18, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 16.8 hours 4. MIN DETECTABLE LIMIT 2.63 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19 mil 7. SELECTED DATA POINTS
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
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	io
	8. OTHER OBSERVATIONS:
5.	SOURCE OF DATA  Samples were run by Sylvia Cooper on June 17-18, 1986.

Chemical Resistance Testing of USCG Material with Ethylene Glycol



Mine. R.Cl.s. 1s.				
TILE: TELTOU TE	minated Nomex			
PROTECTIVE MATE	RIAL CODE: 068			
		visible imperfe	ctions	
PRODUCT IDENTIF	ICATION: Challenge	5100		
DESCRIPTION: M	aterial was orange c	olored on one s	ide and but	f colored on the
other side.				
T METHOD				
TESTING LABORAT	ORY: Texas Research	Institute, 9063	Ree Caves	Road Austin TY
ANALYTICAL METH	OD: Continuous phot	cionization det	ection with	a 10.20 eV lamp.
				. 4 10 120 CV 1445.
	— · · · Z	To used /Detect	OF TARRATA	
DEVIATIONS FROM	ASTY F739 METHOD:	Flow rate to ce	lle was 100	0.00/212
		TOW THEE CO CE	113 MG3 10	CC/MIN.
LIENGE CHEMICAL	1	: COMPONENT	2 :	3
CHEM NAME (s):	Ethyl Ether	. N/A	•	N/A
				N/A
			:	N/A
		_ <del> </del>	:	N/A
OUDITORD DOOROD			:	N/A
T RESULTS				
Breakthpough tim	E: No breakthrough w	as observed aft	er 3.0 hou:	S
SELECTED DATA PO	INTS N/A			
TIME	: CONCENTRATION	: CONCENTR	ATION :	CONCENTRATION
1	•	:	<u> </u>	
2	:	:		
3.		:	:	
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6	<u>:</u>	:	:	
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OTHER OBSERVATION	NS:			
	<u> </u>			
			·	
	CONDITION BEFOR MANUFACTURER: PRODUCT IDENTIF LOT OR MANUFACT NOMINAL THICKNES DESCRIPTION: M	CONDITION BEFORE TEST: Unused, no MANUFACTURER: Chemfab Corp. PRODUCT IDENTIFICATION: Challenge LOT OR MANUFACTURER DATE: N/A NOMINAL THICKNESS: 15-20 mil DESCRIPTION: Material was orange of other side.  T METHOD  TESTING LABORATORY: Texas Research ANALYTICAL METHOD: Continuous phot TEMFERATURE: 22-25°C COLLECTION MEDIUM: N2 COLLECTION SYSTEM: N2 OTHER CONDITIONS: 1 inch cells we DEVIATIONS FROM ASTM F739 METHOD: LIENGE CHEMICAL 1  CHEM NAME(s): Ethyl Ether CAS KUMBER(s): 60-29-7 CONC. (IF MIX) N/A CHEMICAL SOURCE: Aldrich reagent grade T RESULTS  DATE TESTED: July 23, 1986 NUMBER OF SAMPLES TESTED: Three BREAKTHPOUGH TIME: No breakthrough w MIN DATECTABLE LIMIT .13 ppm STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 18-19 mil SELECTED DATA POINTS N/A  TIME : CONCENTRATION  CONCENTRATION  TIME : CONC	CONDITION BEFORE TEST:  MANUFACTURER: Chemfab Corp.  PRODUCT IDENTIFICATION: Challenge 5100  LOT OR MANUFACTURER DATE: N/A  NOMINAL THICKNESS: 15-20 mil DESCRIPTION: Material was orange colored on one sother side.  T METHOD  TESTING LABORATORY: Texas Research Institute, 9063 ANALYTICAL METHOD: Continuous photoionization det TEMFERATURE: 22-25°C  COLLECTION MEDIUM: N2 COLLECTION SYSTY: N2 OTHER CONDITIONS: 1 inch cells were used./Detect DEVIATIONS FROM ASTM F739 METHOD: Flow rate to ce  LIENGE CHEMICAL 1 : COMPONENT  CHEM NAME(s): Ethyl Ether : N/A CAS NUMBER(s): 60-29-7 : N/A CONC. (IF MIX) N/A : N/A CHEMICAL SOURCE: Aldrich reagent : N/A GRAGE : N/A  TIME : CONCENTRATION was observed aft MIN Latertable LIMIT .13 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 18-19 mil SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTR  1. : : : 2. : : : : 3. : : : : 4 : : : : 5 : : : : 6. : : : : : 7 : : : : : 8 : : : : 9 : : : : : 10 : : : : : 10 : : : : : 10 : : : : : 10 : : : : : 10 : : : : : 10 : : : : : 10 : : : : : 10 : : : : : 10 : : : : : 10 : : : : : 10 : : : : : : 10 : : : : : : 10 : : : : : : 10 : : : : : : 10 : : : : : : 10 : : : : : : 10 : : : : : : 10 : : : : : : 10 : : : : : : : 10 : : : : : : : 10 : : : : : : : 10 : : : : : : : : 10 : : : : : : : : 10 : : : : : : : : : 10 : : : : : : : : : : 10 : : : : : : : : : : 10 : : : : : : : : : : : 10 : : : : : : : : : : : : 10 : : : : : : : : : : : : : : : 10 : : : : : : : : : : : : : : : : : :	CONDITION BEFORE TEST: Unused, no visible imperfections MANUFACTURER: Chemfab Corp.  PRODUCT IDENTIFICATION: Challenge 5100  LOT OR MANUFACTURER DATE: N/A NOMINAL TRICKNESS: 15-20 mil DESCRIPTION: Material was orange colored on one side and but other side.  T METHOD  TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves ANALYTICAL METHOD: Continuous photoionization detection with TEMFERATURE: 22-25°C  COLLECTION MEDIUM: N2 COLLECTION SYSTET: N2 OTHER CONDITIONS: 1 inch cells were used./Detector Temperated Deviations FROM ASTM F739 METHOD: Flow rate to cells was 100  LIENGE CHEMICAL 1: COMFONENT 2:  CHEM NAME(s): Ethyl Ether: N/A: CAS KUMBER(s): 60-29-7: N/A: CHEMICAL SOURCE: Aldrich reagent: N/A: GRENICAL SOURCE: Aldrich reagent: N/A: TRESULTS  DATE TESTED: July 23, 1986  NUMBER OF SANPLES TESTED: Three BREAKTHPOUGH TIME: No breaPthrough was observed after 3.0 hour MIN LIECTABLE LIMIT .13 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 18-19 mil SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:  1. : : : : : : : : : : : : : : : : : : :

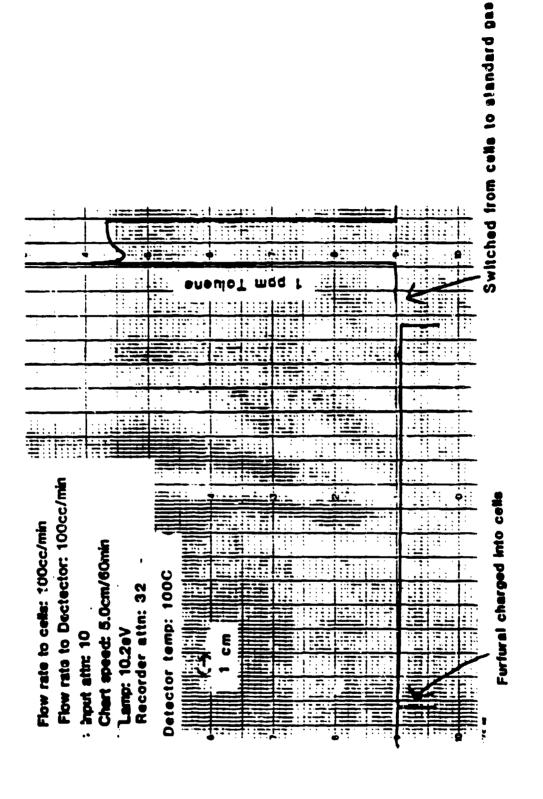
## Chemical Resistance Testing of USCG Material with Ethyl Ether



2.		METHOD			
	1. 1				
	2. A	NALYTICAL METH	ORY: Texas Research In Continuous photo	istitute, 9063 Bee Cav ionization detection w	es Road, Austin, TX ith a 11.70 eV lamp.
		EMPERATURE: 22 OLLECTION MEDI			
	5. C	OLLECTION SYST	EM: N2		
	6. 0	THER CONDITION	S: 2 inch cells were i	used. /Detector Temper	ature = 60C.
	7. D	EVIALIONS PROM	ASTM F739 METHOD:	low rate to cells was	100cc/min.
3.	CHALL	ENCE CHEMICAL	.1	COMPONENT 2 :	3
		HEM NAME (s) :	Formal dehyde	N/A	N/A
			50-00-0	N/A	N/A
	3. C	CONC. (IF MIX)	10-15% CH3CH	N/A	N/A
	4. C	HEMICAL SOURCE	:Fisher ACS reagent	N/A N/A	N/A N/A
			grade	N/A	N/A
4.	TEST	RESULTS			
	4. MI 5. ST 6. SA	N DETECTABLE LEADY STATE PER MPLE THICKNESS LECTED DATA PO	MEATION RATE N/A: 17-19 mil	as observed after 3 ho	urs.
		TIME	: CONCENTRATION	: CONCENTRATION :	CONCENTRATION
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Flow rate to cells: 100cc/Min Flow rate to Detector: 100cc/lingus attn: 1	8.	Balta las Salentes de Para de La la casa de	Ξ.
Flow'r Flow r Input a	2 1 1 1 1		<u>-</u> `
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1:		aminated Nomex ERIAL CODE: 068		
3:			visible imperfections	
4:			value alpha de la constitución d	
5:		FICATION: Challenge	5100	
6:		TURER DATE: N/A		······································
7:		ESS: 15-20 mil		
8:			colored on one side an	d buff colored on t
	other side.			
TE	ST METHOD		•	
1.	TESTING LABORA	TORY: Texas Research	Institute, 9063 Bee C	aves Road, Austin,
2.			toionization detection	with a 10.20 eV la
3.				
4.				
5.				
6.	OTHER CONDITIO	NS: 1 inch cells w	ere used./Detector Tem	perature =100C.
/-	TENTALIZORS NATI	M WELL 1179 WELROD:	Flow rate cells was 10	U cc/min.
CH	ALLENGE CHEMICAL	1	: COMPONENT 2	: 3
				•
	THEM RATE (s):		:N/A	: 7/A
	CAS NUMBER(s):		: N/A	: N/A
	CONC. (IF MIX)		: N/A	: N/A
4.	CHEMICAL SOURCE	E:Aldrich reagent	:N/A	: N/A
		grade	: N/A	:N/A
TE:	ST RESULTS		•	
1.	DATE TESTED: Au	gust 12, 1986		
2.	NUMBER OF SAMPI	ES TESTED: Three		
			was observed after 3.1	hours.
	MIN DETECTABLE			
		RMEATION RATE N/A		
	SAMPLE THICKNES			
7.	SELECTED DATA P	OINTS N/A		
	TIME	: CONCENTRATIO	N : CONCENTRATION	: CONCENTRATION
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8.	OTHER OBSERVATI	ONS:		
8.	OTHER OBSERVATI	ons:		



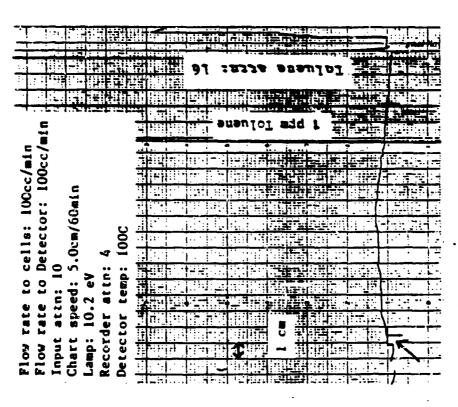
	DESCRIPTION OF PRODU	TOT ETHEONIED		
	5: PRODUCT IDENTIFI 6: LOT OR MANUFACTU 7: NOMINAL THICKNES	TEST: Unused, no vi Chemfab Corp. CATION: Challenge 51 RER DATE: N/A SS: 15-20 mil	sible imperfections  Out	ouff colored on the
•	other side. TEST METHOD			
	2. ANALYTICAL METHO 3. TEMPERATURE: 22- 4. COLLECTION MEDIO 5. COLLECTION SYSTI 6. OTHER CONDITIONS	DD: Continuous photoi -25°C JM: N2 EM: N2	onization detection with used. /Detector Temper A	th a 10.20 eV lamp.
•	CHALLENGE CHEMICAL	1 :	COMPONENT 2 :	3
	1. CHEM NAME(s): 2. CAS WAMBER(s): 3. CONC. (IF MIX) 4. CHEMICAL SOURCE	N/A N/A	N/A N/A N/A N/A	N/A N/A N/A N/A
	1. DATE TESTED: Se 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PERI 6. SAMPLE THICKNESS 7. SELECTED DATA PO	TESTED: Three  : No breakthrough was IMIT 1.65 ppm MEATION RATE N/A : 18-19 mil	observed after 14.9	nours.
	TIME	CONCENTRATION	: CONCENTRATION :	CONCENTRATION
	2. 3.			
	4			
	6.			
	8.			
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	8. OTHER OBSERVATIO	NS:		

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00cc/win							
00cc/win							
100cc/min							
Detector: 100cc/min 5.0cm/60min : 32 : 100c							
to Detector: 100cc/min : 10 d: 5.0cm/60min ev ttn: 32 emp: 100C							
tn: 10 ted: 5.0cm/60min .2 eV temp: 100C							
stn: 10 speed: 5.0cm/60min 10.2 ev der sten: 32 tor temp: 100C							
te to Detector: 100cc/min ttn: 10 peed: 5.0cm/60min 0.2 ev r ættn: 32 r temp: 100c							

emical Resistance Testing of USCG with Gasoline

1.	DESCRIPTION OF PRODUC	T EVALUATED		
		AL CODE: 068 TEST: Unused, no emfab Corp. ATION: Challenge:	visible imperfections	
	6: LOT OR MANUFACTUR 7: NOMINAL THICKNESS 8: DESCRIPTION: Matorial other side.	: 15-20 mil	olored on one side and	buff colored on the
2.	TEST METHOD			
•	2. ANALYTICAL METHOD 3. TEMPERATURE: 22-2 4. COLLECTION MEDIUM 5. COLLECTION SYSTEM 6. UTHER CONDITIONS:	: Continuous phot 5°C : N2 : N2 I inch cells wer	Institute, 9063 Bee Cavoionization detection we used./ Detector Tempe Flow rate to cells was	rature = 100c.
3.	CHALLENGE CHEMICAL	1	: COMPONENT 2 :	3
	1. CHEM NAME(s): 6 2. CAS NUMBER(s): T 3. CONC. (IF MIX) N 4. CHEMICAL SOURCE: A	11-30-8 /A	N/A N/A N/A N/A	N/A N/A N/A N/A
4.	1. DATE TESTED: Sept 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN	TESTED: Three N/A IT43 ppm ATION RATE N/A 19-20 mil		
-	TIME :	CONCENTRATION	: CONCENTRATEON :	CONCENTRATION
	3.			
	5.			
	6. <u>:</u>			
	8			
	10:		<u>:</u>	
	8. OTHER OBSERVATIONS	:		
5.	SOURCE OF DATA Samples were	run by Denise McDo	nald on September 19, 1	986.

## Chemical Resistance Testing of USCG Material with Glutaraldehyde



Glutaraidehyde charged into cells

Switched from cells to standard gas

1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex
	2: PROTECTIVE MATERIAL CODE: 068
	3: CONDITION BEFORE TEST: Unused, no visible imperfections
	4: MANUFACTURER: Chemfab Corp.
	5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A
	7: NOMINAL THICKNESS: 15-20 mil
	8: DESCRIPTION: Material was orange colored on one side and buff colored on the
	other side.
2.	TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp.
	3. TEMPERATURE: 22-25°C
	4. COLLECTION MEDIUM: No
	5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cells were used./ Detector Temperature = 60C.
	7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100cc/min.
_	
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. CHEM WAME(s): Hexane : N/A : N/A
	2. CAS NUMBER(s): 110-54-3 : N/A : N/A
	3. CONC. (IF MIX) N/A : N/A : N/A
	4. CHEMICAL SOURCE: Aldrich reagent : N/A : N/A
4.	TEST RESULTS : N/A : N/A
•	· · · · · · · · · · · · · · · · · · ·
	1. DATE TESTED: June 16-17, 1986
	2. NUMBER OF SAMPLES TESTED: Three
	3. BREAKTHROUGH TIME: No breakthrough was observed after 11 hours. 4. MIN DETECTABLE LIMIT .25 ppm
	5. STEADY STATE PERMEATION RATE N/A
	6. SAMPLE THICKNESS: 19 mil
	7. SELECTED DATA POINTS
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1.
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	3:::::::
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	7.
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	8. OTHER OBSERVATIONS:
	O. VINER WOSERVALIUMS.
5.	SOURCE OF DATA
	Samples were run by Sylvia Cooper on June 16-17, 1986.

Chemical Resistance Testing of USCG Material with Hexane

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Flow rate to cells: 100cc/min Flow rate to Detector: 100cc/min Input aitn: 1	necorder 2000. 7 Charl speed: 6.0cm/60mln	•	.			أننزا			T			1.1.			[:::	-	1	
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	6: LOT OR MANUFACTU 7: NOMINAL THICKNES	IAL CODE: 068 TEST: <u>Unused, no vis</u> hemfab Corp. CATION: <u>Challenge 510</u> RER DATE: N/A	1	
2.	2. ANALYTICAL METHO 3. TEMPERATURE: 22- 4. COLLECTION MEDIU 5. COLLECTION SYSTE 6. OTHER CONDITIONS	M: N <sub>2</sub>	nization detection	with a 10.2 eV lamp.  sperature = 1000.
L	CHALLENGE CHEMICAL	1 :	COMPONENT 2	: 3
١.	1. CHEM NAME(s): 2. CAS NUMBER(s): 3. CONC. (IF MIX) 4. CHEMICAL SOURCE: TEST RESULTS	10217-52-4 N/A	N/A N/A N/A N/A	N/A N/A N/A
•	1. DATE TESTED: Sept 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI	TESTED: Three : N/A MIT 0.9 ppm. EATION RATE N/A 19-20 mil		
	TIME :	CONCENTRATION	: CONCENTRATION	: CONCENTRATION :
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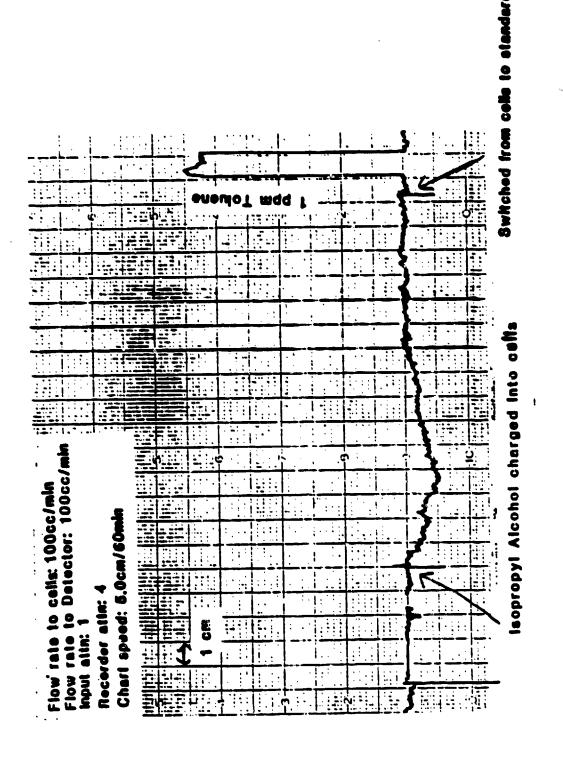
Hydrazine charged this cetts

	DESCRIPTION OF PROD	DUCT EVALUATED		
	1: TYPE: Teflon la	aminated Nomex		
	2: PROTECTIVE MATE	RIAL CODE: 068		
		RE TEST: Unused, no v	isible imperfections	
	4: MANUFACTURER: 5: PRODUCT IDENTIF	ICATION: Challenge 5	100	
	6: LOT OR MANUFACT	TURER DATE: N/A		
	7: NOMINAL THICKNE			
	8: DESCRIPTION: Nother side.	naterial was orange co	lored on one side and I	buff colored on the
2.	TEST METHOD-			
	1. TESTING LABORAT	TORY: Texas Research I	nstitute, 9063 Bee Cav	es Road. Austin. TX
	2. ANALYTICAL METH	iOD: <u>Colorimetric;</u> Fe	rrithiocyanate method	
	3. TEMPERATURE: And 4. COLLECTION MEDI	nbient		
	4. COLLECTION MEDI 5. COLLECTION SYST			
	6. OTHER CONDITION	S: 2 inch cells wer	e used.	
	7. DEVIATIONS FROM	ASTM F739 METHOD:		
3.	CHALLENGE CHEMICAL	1	: COMPONENT 2 :	3
	1. CHEM NAME(s):			N/A
	2. CAS NUMBER(s):	77 22-84-1	: <u>N/A</u> :	ft/A
	3. CONC. (IF MIX) 4. CHEMICAL SOURCE		: N/A :	N/A N/A
	2. NUMBER OF SAMPLE	ME: No breakthrough w IMIT 0.6 ppm RMEATION RATE N/A	as observed after 3 ho	urs.
	7. SELECTED DATA PO			
			_	······································
	TIME 1. 3 Hours	: CONCENTRATION	: CONCENTRATION :	CONCENTRATION
	2. 3 nours	: <0.6 ppm	: <0.6 ppm	<0.6 ppm
	3.		:	
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		•	<u>:</u> :	
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	7. 8.			
	7. 8. 9.	:		
	7. 8. 9. 10.	: : : : : : : : : : : : : : : : : : :	: : : : : : : : : : : : : : : : : : :	O ppm standards were
	7. 8. 9. 10.	: : : ONS: <u>A reagent blank</u>	i : i : and 0.6,1.5,3.0 and 6.0	O ppm standards were

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, ι	DESCRIPTION OF PRODUCT EAVEOWLED		
1	1: TYPE: Teflon laminated Nomex		
	2: PROTECTIVE MATERIAL CODE: 068		
3	3: CONDITION BEFORE TEST: Unused, no v	risible imperfections	
	: MANUFACTURER: Chemfab Corp.		
	5: PRODUCT IDENTIFICATION: Challenge 5	100	
	LOT OR MANUFACTURER DATE: N/A		
	7: NOMINAL THICKNESS: 15-20 mil B: DESCRIPTION: <u>Material was orange co</u>	loned on one side as	d buff coloned on the
•	other side.	NOTEL ON ONE SIDE EN	d bott corored on the
1	TEST METHOD	•	
1	1. TESTING LABORATORY: Texas Research I	nstitute, 9063 Bee C	aves Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous photo	pionization detection	with a 11.7 eV lamp.
	3. TEMPERATURE: 22-25°C		
	4. COLLECTION MEDIUM: No		
	COLLECTION SYSTEM: No COLLECTION SYSTEM: NO COLLECTION SYSTEM: NO	used / Detector Temp	
	7. DEVIATIONS FROM ASTM F739 METHOD: F1		
•	DEVIATIONS - NOT POINT FFOO NETHERS	ON TRUE CO GETTS WELL	
C	CHALLENGE CHEMICAL 1	: COMPONENT 2	: 3 :
	i. CHEM NAME(s): Isopropyl Alcohol	:N/A	: N/A
2	2. CAS NUMBER(s): 67-63-0	: N/A	: N/A
	B. CONC. (IF MIX) N/A	: N/A	: N/A
4	. CHEMICAL SOURCE: Mallinckrodt	. N/A	: N/A
1	Regeant Grade TEST RESULTS	: N/A	:N/A
34 5	L. DATE TESTED:  2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was  4. MIN DETECTABLE LIMIT 1.16ppm:  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 19mil.  7. SELECTED DATA POINTS N/A		ours.
	TIME : CONCENTRATION	: CONCENTRATION	: CONCENTRATION
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	9.	<u> </u>	:
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8	B. OTHER OBSERVATIONS:		
. S	SOURCE OF DATA Samples were run by Sylvia R.	Cooper on June 23,	1986.

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1:				
2: 3:		TEST: Unused, no V	ethle (morfections	
4:	MANUFACTURER: CI		SIDIE IMPELIECTIONS	
5:		ATION: Challenge 5	100	
6:				
7:				
8:	DESCRIPTION: May	erial was orange co.	lored on one side and	buff colored on th
	other side.			
TE	ST METHOD			
1.	TESTING LABORATOR	RY: 1exas Research Ty	estitute, 9063 Bee Car	ves Road, Austin, T
2.	ANALYTICAL METHO	: Continuous photo:	ionisation detection	uith & 11.70 eV lan
3.	TEMPERATURE: 22-	23 C		
	COLLECTION MEDIU			
_	COLLECTION SYSTEM			-4 Ar
7	OTHER CONDITIONS	LE W #730 METHOD. E	used/Detector Temper low rate to cells was	10000/215
•	WEATHTING LYNN	erra elas estempi s.	TOA TELE TO EASTE ASS	PAAPEL WTH
	CIEME DESIGNA	1 :	COMPONENT 2	; <b>3</b>
1.	CHEM WATE( ):	Isopropy lemine	W/A	• : ¥/A
	CAS NUMBER(s):	75-31-0	N/A	: N/A
		N/A	N/A	: N/A
4.	CREMICAL SOURCE:	Aldrich reagent	N/A	: N/A
		rade	N/A	: N/A
TE	ST RESULTS	\\\		
	D	20 1004		
	DATE TESTED: May			· · · · · · · · · · · · · · · · · · ·
•	NUMBER OF SAMPLES		as observed after 3 h	#11 T.O.
_	MIN DETECTABLE LI		WE OPERAGG SIFEL 2 II	OU. B
	STEADY STATE PERM			
	SAMPLE TRICKNESS:			<del></del>
	SELECTED DATA POL			
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	TIME :	Concentration	: CONCENTRATION	: CONCENTRATION
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8.	OTHER OBSERVATION			

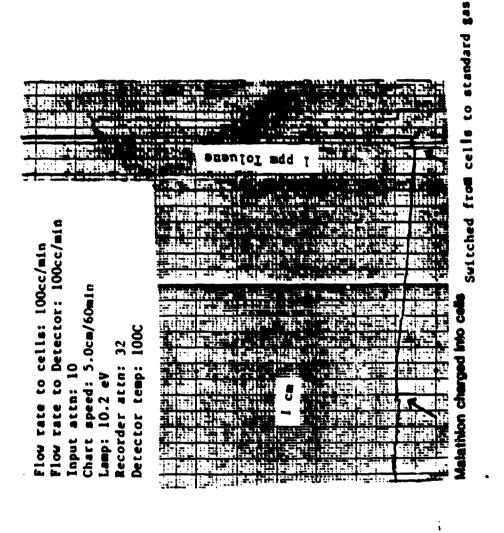
Chemical Resistance Testing of USCG Material with Isopropylamine

Tobes	
	9 11824819
	Satisted from come to standard
	SERVED
6.0cm/00mb 6.0cm/00mb	
	•

opropylamine charged into cells

1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MARKETAL CODE: 068 3: CONGUITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored other side.  2. TEST METHOD 3. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Aust 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 e 3. TEMPERATURE: 22-25 to 4. COLLECTION NOSTEM: N/2 6. OTHER CONDITIONS: 1 inch cells re used./ Detector Temperature = 100 for the conditions of the collection of the	DESCR	RIPTION	OF PROD	DUCT EVAL	UATED					
3: CONCITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT 10E MITFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: MONINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored other side.  7: TEST METHOD  3. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Aust 2: ANALYTICAL METHOD: Continuous photoionization detection with a 10:20 et 3. TEMPERATURE: 22-25 °C. 4. COLLECTION MEDIUM: No. 5. COLLECTION MEDIUM: No. 6. OTHER CONDITIONS: Inch cells re used./ Detector Temperature = 100 7. DEVIATIONS FROM ASTM F739 METHOD: N.A 8. CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. DMEN MAYE(s): Malathion : N/A : N/A : N/A 2. CAS MEMBER(s): N/A : N/A : N/A : N/A 3. CDNC. (IF MIX) 50% : N/A : N/A : N/A 4. CHEMICAL SOURCE: Black Teaf products: N/A : N/A 4. CHEMICAL SOURCE: Black Teaf products: N/A : N/A 5. TEST RESULTS 1. DATE TESTED: September 5, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 2.10 hours. 4. MIN DETECTABLE LIMIT 1.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRAT 1. : : : : : : : : : : : : : : : : : : :	1: T	TYPE: T	eflon l	aminated	Nomex					
4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored other side.  TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Aust 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 et 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 et 2. COLLECTION MEDIUM: N2 6. COLLECTION MEDIUM: N2 6. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: N2 7. DEVIATIONS FROM ASTM F739 METHOD: N. A 7. DEVIATIONS FROM ASTM F739 METHOD: N. A 7. CHALLENGE CHEMICAL 1 COMPONENT 2: 3 1. DMEM MASE(s): Malathion : N/A : N/A 2. CAS MUMBER(s): N/A : N/A : N/A 3. CONC. (IF MIX) 50% N/A : N/A : N/A 4. CHEMICAL SOURCE: Black leaf products: N/A : N/A 5. TEST RESULTS 1. DATE TESTED: September 5, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 2.10 hours. 4. MIN DETECTABLE LIMIT I.U3 DPM 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRAT 1. CONCENTRATION : CONCENTRATION : CONCENTRAT 2. : : : : : : : : : : : : : : : : : : :	2: P	PROTECT	IVE MATE	RIAL COD	E: 068					
5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored other side.  TEST METHOD: Continuous photoionization detection with a 10.20 e 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N <sub>2</sub> 6. OTHER CONDITIONS: I inch cells re used./ Detector Temperature = 100 7. DEVIATIONS FROM ASTM F739 METHOD: N/A  CHALLENGE CHEMICAL 1: COMPONENT 2: 3 1. DREM MARE(s): Melathion: N/A: N/A 2. CAS MINDER(s): Melathion: N/A: N/A 3. CONC. (If MIX) 50%: N/A: N/A: N/A 4. CHEMICAL SOURCE: Black leaf products: N/A: N/A 7. TEST RESULTS 1. DATE TESTED: September 5, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 2.10 hours. 4. MIN DETECTABLE LIMIT 1.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED CATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRAT 1. CONC. II MIX N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED CATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRAT 1. CONCENTRATION: CONCENTRATION: CONCENTRAT 1. CONCENTRATION: CONCENTRATION: CONCENTRAT 1. CONCENTRATION: CONCENTRATION: CONCENTRAT 1. CONCENTRATION: CONCENTRATION: CONCENTRAT 1. CONCENTRATION: CONCENTRATION: CONCENTRAT 1. CONCENTRATION: CONCENTRATION: CONCENTRAT 1. CONCENTRATION: CONCENTRATION: CONCENTRAT 2. CONCENTRATION: CONCENTRATION: CONCENTRAT 3. CONC. CONCENTRATION: CONCENTRATION: CONCENTRAT 4. CONCENTRATION: CONCENTRATION: CONCENTRAT 5. CONCENTRATION: CONCENTRATION: CONCENTRAT 6. CONCENTRATION: CONCENTRATION: CONCENTRAT 1. CONCENTRATION: CONCENTRATION: CONCENTRAT 1. CONCENTRATION: CONCENTRATION: CONCENTRAT 1. CONCENTRATION: CONCENTRATION: CONCENTRAT 1. CONCENTRATION: CONCENTRATION: CONCENTRAT 1. CONCENTRATION: CONCENTRATION: CONCENTRAT 3. CONC. CONCENTRATION: CONCENTRATION: CONCENTRAT 4. CONCENTRATION: CONCENTRATION: CONCENTRAT 5. CONCENTRATION: CONCENTRATION: CONCENTRATION: CONCENTRATION: CONCENTRATION: CONCENTRATION: CONCENTRATION: CONCENTRATIO						visit	le imperfes	tions		
6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mm1 8: DESCRIPTION: Material was orange colored on one side and buff colored other side.  TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Aust 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 e 3. TEMPERATURE: 22-25 C 4. COLLECTION MEDIUM: N2 5. COLLECTION MEDIUM: N2 6. OTHER CONDITIONS: 1 Inch cells re used./ Detector Temperature = 1000 r 7. DEVIATIONS FROM ASTM F739 METHOD: N/A 7. DEVIATIONS FROM ASTM F739 METHOD: N/A 8. CAS MEMBER(s): Malathion: N/A: N/A 9. CAS MEMBER(s): N/A: N/A: N/A 9. CAS MEMBER(s): N/A: N/A: N/A 9. CHEMICAL SOURCE: BTack leaf products: N/A: N/A: N/A 1. TEST RESULTS 1. DATE TESTED: September 5, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: NO breakthrough was observed after 3.10 hours. 4. MIN DETECTABLE LIMIT 1.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mm1 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRAT 1										
7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side and buff colored other side.  TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Aust 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 e 3. TEMPERATURE: 22-25 TC 4. COLLECTION MEDIUM: No. 5. COLLECTION SYSTEM: No. 6. OTHER CONDITIONS: 1 inch cells re used./ Detector Temperature = 1000 pt 100						5100				
8: DESCRIPTION: Material was orange colored on one side and buff colored other side.  TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Aust 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 e 3. TEMPERATURE: 22-25 e 4. COLLECTION MEDIUM: No collection within a 10.20 e 6. OTHER CONDITIONS: I inch cells re used./ Detector Temperature = 100 e 7. DEVIATIONS FROM ASTM F739 METHOD: 1.44  CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3  1. DMEM MARE(s): Malathion : N/A :										
Other side.  TEST METHOD  TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Aust 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 e 3. TEMPERATURE: 22-25 €  4. COLLECTION MEDIUM: No. 5. COLLECTION SYSTEM: No. 6. OTHER CONDITIONS: I inch cells re used./ Detector Temperature = 100 7. DEVIATIONS FROM ASTM F739 METHOD: No. 7. DEVIATIONS FROM ASTM F739 METHOD: No. 8. CHALLENGE CHEMICAL 1: COMPONENT 2: 3  1. THEN MARE(s): Malathion No. 8. No. (IF MIX) 50% No. (No. (No. (No. (No. (No. (No. (No.								<del>, , , , , , , , , , , , , , , , , , , </del>		
1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Aust 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 e 3. TEMPERATURE: 22-25 C 4. COLLECTION MEDIUM: No 5. COLLECTION SYSTEM: No 6. OTHER CONDITIONS: I inch cells re used./ Detector Temperature = 1000 7. DEVIATIONS FROM ASTM F739 METHOD: No 7. DEVIATIONS FROM ASTM F739 METHOD: No 8. CHARLENGE CHEMICAL 1 COMPONENT 2 : 3 1. EMEM MANE(s): Malathion : N/A : N/A : N/A 3. CONC. (IF MIX) 50% N/A : N/A : N/A 4. CHEMICAL SOURCE: Black leaf products: N/A : N/A : N/A 7. TEST RESULTS 1. DATE TESTED: September 5, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 2.10 hours. 4. MIN DETECTABLE LIMIT 1.03 ppm 5. SIEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRAT 1. : : : : : : : : : : : : : : : : : : :		other	side.	Material	was orange	COLOR	a on one \$1	de and b	UTT COL	orea on the
2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 e 3. TEMPERATURE: 22-25 C 4. COLLECTION MEDIUM: No	TEST	METHOD						_		
2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 e 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cells re used./ Detector Temperature = 100 7. DEVIATIONS FROM ASTM F739 METHOD: N4 7. DEVIATIONS FROM ASTM F739 METHOD: N4 7. CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. DHEM MARE(s): Malathion : N/A : N/A 2. CAS MEMBER(s): N/A : N/A : N/A 3. CONC. (IF MIX) 50% : N/A : N/A : N/A 4. CHEMICAL SOURCE: Black Teaf products : N/A : N/A 7. TEST RESULTS 1. DATE TESTED: September 5, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BERKH HROUGH TIME: No breakthrough was observed after 2.10 hours. 4. MIN DETECTABLE LIMIT 1.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRAT 1. : : : : : : : : : : : : : : : : : : :	1. T	TESTING	LABORAT	TORY: Tex	as R <b>esea</b> rch	n Inst	tute, 9063	Bee Cave	s Road.	Austin, T
3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: No 5. COLLECTION SYSTEM: No 6. OTHER CONDITIONS: 1 inch cells re used./ Detector Temperature = 1000 7. DEVIATIONS FROM ASTM F739 METHOD: NA 7. CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. DMEM MARE(s): Malathion : N/A : N/A : N/A 3. CONC. (IF MIX) 50% : N/A : N/A : N/A 4. CHEMICAL SOURCE: Black leaf products : N/A : N/A : N/A 7. TEST RESULTS 1. DATE TESTED: September 5, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 2.10 hours. 4. MIN DETECTABLE LIMIT 1.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRAT 1. : : : : : : : : : : : : : : : : : : :	2. A	ANAL YT I	CAL METH	HOD: Con	tinuous pho	toion	zation dete	ction wi	th a 10	.20 eV am
5. COLLECTION SYSTEM: No 6. OTHER CONDITIONS: I inch cells re used./ Detector Temperature = 1000 7. DEVIATIONS FROM ASTM F739 METHOD: NA 7. DEVIATIONS FROM ASTM F739 METHOD: NA 7. CHALLENGE CHEMICAL I COMPONENT 2 : 3 1. THEM MARE(s): Malathium : N/A N/A N/A 2. CAS MUMBER(s): N/A N/A N/A N/A 3. CONC. (IF MIX) 50% N/A N/A N/A 4. CHEMICAL SOURCE:Black leaf products : N/A N/A N/A  TEST RESULTS 1. DATE TESTED: September 5, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 1.10 hours. 4. MIN DETECTABLE LIMIT 1.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED CATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRAT 1. : : : : : 3. : : : : : : 4. : : : : : : : 5. : : : : : : : 7. : : : : : : : : 8. : : : : : : : : : : 9. : : : : : : : : : : 10. : : : : : : : : : : : 11. : : : : : : : : : : : : 12. : : : : : : : : : : : 13. : : : : : : : : : : : : 14. : : : : : : : : : : : : : : 15. : : : : : : : : : : : : : : : : 16. : : : : : : : : : : : : : : : : 17. : : : : : : : : : : : : : : : : : : :	3. T	TEMPERA'	TURE: 22	2-25 °C						
6. OTHER CONDITIONS: 1 inch cells re used./ Detector Temperature = 1000 7. DEVIATIONS FROM ASTM F739 METHOD: N/A  . CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3  1. THEM MARE(s): Malathism : N/A : N/A 2. CAS NUMBER(s): N/A : N/A : N/A 4. CHEMICAL SOURCE: Black leaf products : N/A : N/A 4. CHEMICAL SOURCE: Black leaf products : N/A : N/A  . TEST RESULTS  1. DATE TESTED: September 5, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 2.10 hours. 4. MIN DETECTABLE LIMIT 1.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 m11 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRAT 1. : : : : : : : : : : : : : : : : : : :										
7. DEVIATIONS FROM ASTM F739 NETHOD: 1.74  . CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3  1. DHEM NAME(s): Malathion : N/A :										
1. THEM NAME(s): Malathion : N/A							ed./ Detect	or lempe	rature	= 100C.
2. CAS MUMBER(s): N/A	CHALL	LENGE CI	HEMICAL		1		COMPONENT 2	:		3
2. CAS MUMBER(s): N/A :	1. 10	THEM MAY	ef (a) -	Mal athi	nn.	•	N/A	•		W /A
3. CONC. (IF MIX) 50% : N/A : N/A 4. CHEMICAL SOURCE: Black leaf products : N/A : N/A  TEST RESULTS  1. DATE TESTED: September 5, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3.10 hours. 4. MIN DETECTABLE LIMIT 1.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRAT  1. : : : : : : : : : : : : : : : : : : :						— <u>;</u> —				
4. CHEMICAL SOURCE:Black leaf products: N/A : N/A  TEST RESULTS  1. DATE TESTED: September 5, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3.10 hours. 4. MIN DETECTABLE LIMIT 1.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRAT 1. : : : : : : : : : : : : : : : : : : :						;				
1. DATE TESTED: September 5, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 2.10 hours. 4. MIN DETECTABLE LIMIT 1.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRAT  2					eaf product	3				
7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRAT  1.	2. NU 3. BR 4. MI 5. ST	IUMBER OI BREAKTHRI IIN DETEI ITEADY S'	F SAMPLE OUGH TIN CTABLE L TATE PER	ES TESTED ME: No br LIMIT 1.0 RMEATION	: Three eakthrough 3 ppm RATE N/A	Was Ol	oserved afte	r 2.10 h	ours.	
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8. OTHER OBSERVATIONS:	10	·	<del> </del>	•				<u>-</u>		
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Samples were run by Karen Verschoor on September 5, 1986.	JU :JR( U			eus ku Y	aren Venest		Cantasha-	5 109 <i>6</i>		

## Chemical Resistance Testing of USCG Material with Malathion

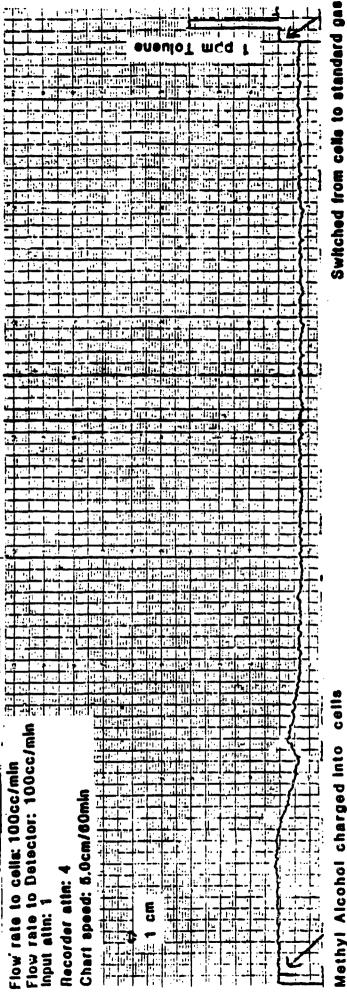


1.	DESCRIPTION OF PRODUCT EVALUATED		
	1: TYPE: Teflon laminated Nomex		
	2: PROTECTIVE MATERIAL CODE: 068		
	3: CONDITION BEFORE TEST: Unused, no 4: MANUFACTURER: Chemfab Corp.	VISIBLE IMPERTECTIONS	
	5: PRODUCT IDENTIFICATION: Challenge	5100	
	6: LOT OR MANUFACTURER DATE: N/A		
	7: NOMINAL THICKNESS: 15-20 mil		
	8: DESCRIPTION: Material was orange other side.	colored on one side and	buff colored on the
2.	TEST METHOD		
	1. TESTING LABORATORY: Texas Research	Institute, 9063 Bee Cav	es Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous pho	<u>toionization detection w</u>	ith a 10.20 eV lamp.
	3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2		
	5. COLLECTION SYSTEM: No	<del></del>	
	6. OTHER CONDITIONS: 1 inch cells w	ere used. /Detector Temp	erature = 100C.
	7. DEVIATIONS FROM ASTM F739 METHOD:	N/A	
3.	CHALLENGE CHENICAL 1	: COMPONENT 2 :	3
	.1. CHEM NAME(s): Methyl Acrylate	N/A :	N/A
	2. CAS NUMBER(s): 96-33-3	: N/A :	N/A
	3. CONC. (IF MIX) N/A	:N/A:	N/A
	4. CHEMICAL SOURCE: Aldrich reagent	N/A N/A	N/A N/A
4.	TEST RESULTS		4/7
	1 04TE TEATED A 2 24 14 1006		
	1. DATE TESTED: August 14, 1986 2. NUMBER OF SAMPLES TESTED: Three	(composite)	
	3. BREAKTHROUGH TIME: No breakthrough	was observed after 3.7	hours.
	4. MIN DETECTABLE LIMIT_0.48 ppm		
	5. STEADY STATE PERMEATION RATE N/A		
	6. SAMPLE THICKNESS: 18-19 mil		
	7. SELECTED DATA POINTS N/A		
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	8. OTHER OBSERVATIONS:		
	or other watering to the contract of the contr		
5.	SOURCE OF DATA		
	Samples were run by Sylvia Coo	per on August 14, 1986.	The same of the sa

### Chemical Resistance Testing of USCG with Methyi Acrylate

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1.	DESCRIPTION OF PRODUCT EVALUATED	
	1: TYPE: Teflon laminated Nomex	
	2: PROTECTIVE MATERIAL CODE: 068	
	3: CONDITION BEFORE TEST: Unused, no visi	ble imperfections
	4: MANUFACTURER: Chemfab Corp.	
	5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A	
	7: NOMINAL THICKNESS: 15-20 mil	
	8: DESCRIPTION: Material was orange color	ed on one side and buff colored on the
	other side.	es on one state and barricordice on one
2.	. TEST METHOD	
	1. TESTING LABORATORY: Texas Research Inst	itute, 9063 Bee Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous photogor	ization detection with a 11.7 eV lamp.
	3. TEMPERATURE: 22-25°C	
	4. COLLECTION MEDIUM: N2	
	5. COLLECTION SYSTEM: No	- / D
	6. OTHER CONDITIONS: I inch cells were use 7. DEVIATIONS FROM ASTH \$7.39 NETHOD: Flow	d./ Detector Temperature = but.
	1. TENTALIUM FROM NOM SHOW RELINOUS FLOW	rate to the cells was Junce/min
۵,	. CHALLENGE CHEMICAL 1 :	COMPONENT 2 : 3
	1. THEM WAME (s): Methyl Alcohol:	N/A : N/A
	2. CAS NUMBER(s): 67-56-1 :	N/A : N/A
	3. CONC. (IF MIX) N/A :	N/A : N/A
	4. CHEMICAL SOURCE: Mallinckrodt :	N/A : N/A
4.	Reagent Grade :	N/A : N/A
•		
	1. DATE TESTED: June 19-20, 1986	
	2. NUMBER OF SAMPLES TESTED: Three	
	3. BREAKTHROUGH TIME: No breakthrough was of 4. MIN DETECTABLE LIMIT 4.07ppm	observed atter 14.2 nours.
	5. STEADY STATE PERMEATION RATE N/A	
	6. SAMPLE THICKNESS: 18-19 mil.	<del></del>
	7. SELECTED DATA POINTS N/A	
	TIME : CONCENTRATION :	CONCENTRATION : CONCENTRATION
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	10.	
	8. OTHER OBSERVATIONS:	
£	SCURCE OF DATA	
٥.	Source OF DATA  Samples were run by Karen Verscho	or on June 19-20, 1986.



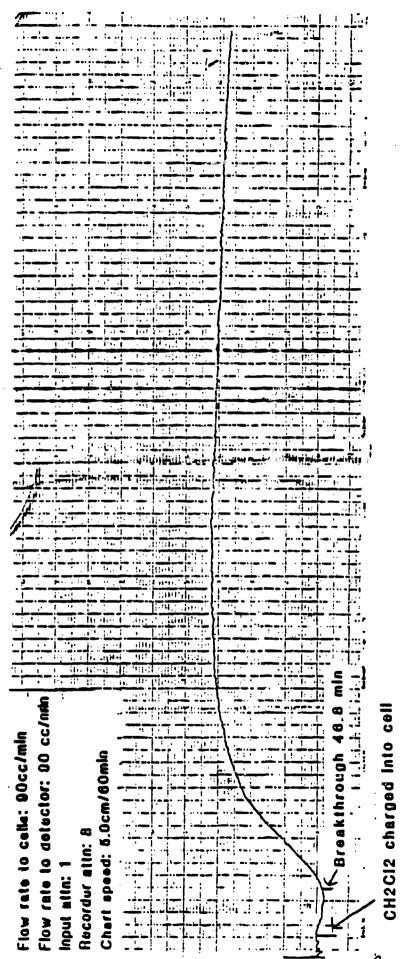
Methyl Alcohol charged into

C-165

۷٠	TEST METHOD  1. TESTING LABORAT			
	2 ANALYTICAL METH	MOV. Tausa Barasa h Na		B A .A.C. TV
	2. MINLITIONE TEIN	IOD: Continuous photoi	onization detection w	es koad, Austin, IX ith a 11.7 eV Tamp.
	3. TEMPERATURE: 22 4. COLLECTION MEDI	2-25-C UM: No	· · · · · · · · · · · · · · · · · · ·	
	5. COLLECTION SYST	EM: No		(00
	7. DEVIATIONS FROM	IS: 2 inch cell was u	ow rate to cells was	90cc/min.
3.	CHALLENGE CHEMICAL	1 :	COMPONENT 2 :	3
	T CHEM MINE != ) .	: Methylene Chloride	N/A :	n/A
	CAS NUMBER(s):		N/A	N/A
	3. CONC. (IF MIX)		N/A	N/A
	4. CHEMICAL SOURCE	:Fisher Pesticide : Grade :	N/A N/A	N/A N/A
4.	TEST RESULTS	°		
	1. DATE TESTED: Ap	oril 21-22, 1986		
	2. NUMBER OF SAMPLE	S TESTED: One (Run 1)		
	3. BREAKTHROUGH TIM 4. MIN DETECTABLE L			
	5. STEADY STATE PER	MEATION RATE 1.37ug/	cm² hour	
	& CAMDIE THIPPNECE			ماريون والمراجع المراجع والمراجع والم والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع و
	<ol> <li>SAMPLE THICKNESS</li> <li>SELECTED DATA PO</li> </ol>			
	7. SELECTED DATA PO		: CONCENTRATION :	CONCENTRATION
	7. SELECTED DATA PO	OINTS	: CONCENTRATION :	CONCENTRATION
	7. SELECTED DATA PO	OINTS	: CONCENTRATION :	CONCENTRATION
	7. SELECTED DATA PO	OINTS	: CONCENTRATION :	CONCENTRATION
	7. SELECTED DATA PO	OINTS	: CONCENTRATION :	CONCENTRATION
	7. SELECTED DATA PO	OINTS	: CONCENTRATION :	CONCENTRATION
	7. SELECTED DATA PO  TIME  1. 2. 3. 4. 5. 6. 7. 8.	OINTS	: CONCENTRATION :	CONCENTRATION
	7. SELECTED DATA PO  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	OINTS	: CONCENTRATION :	CONCENTRATION
	7. SELECTED DATA PO  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	CONCENTRATION  CONCENTRATION  CONCENTRATION  CONCENTRATION	: CONCENTRATION :	CONCENTRATION
	7. SELECTED DATA PO  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	CONCENTRATION  CONCENTRATION  CONCENTRATION  CONCENTRATION	: CONCENTRATION :	CONCENTRATION
5.	7. SELECTED DATA PO  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	CONCENTRATION  CONCENTRATION  CONCENTRATION  CONCENTRATION	: CONCENTRATION :	CONCENTRATION

## Permeation of Methylene Chloride through USCG Material

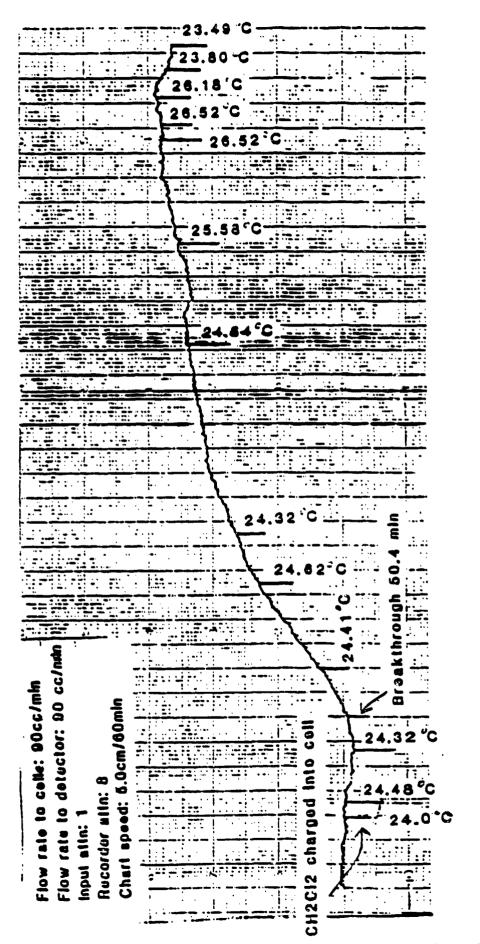
Run 1



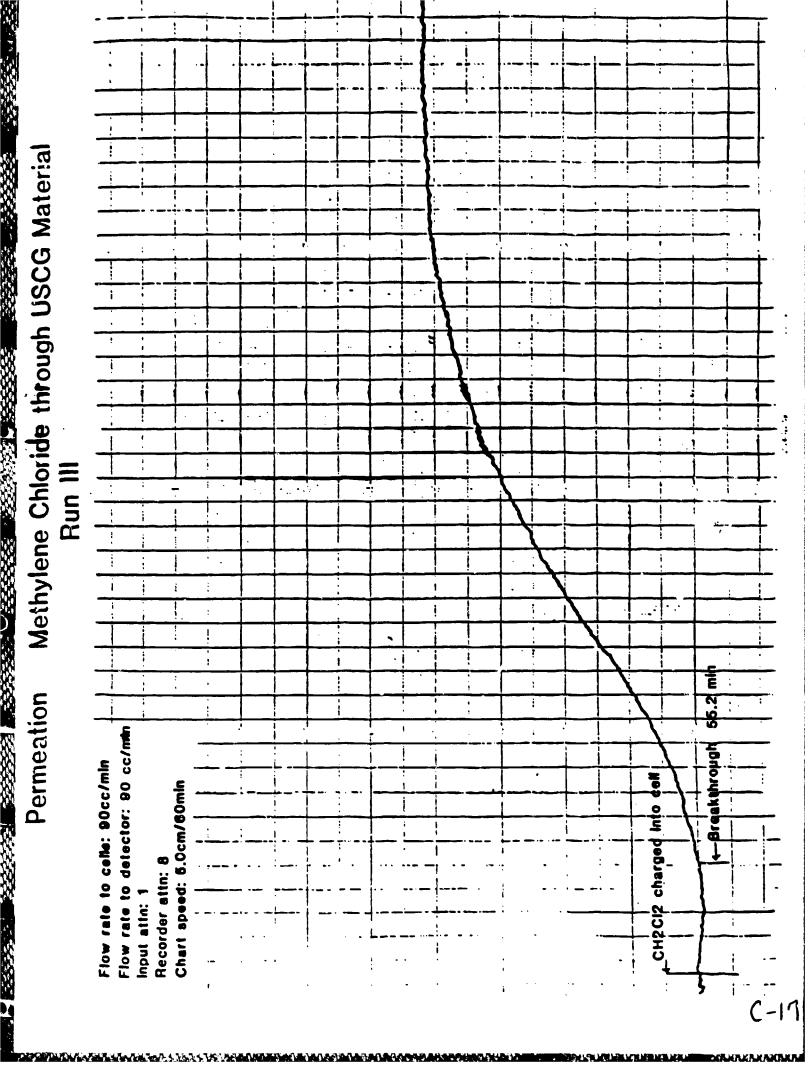
C-16"

4:	MANUFACTURER:	ORE TEST: <u>Unused, no v</u> Chemfab Corp.		S
5: 6:		IFICATION: Challenge 5 CTURER DATE: N/A	100	
7:		VESS: 15-20 mil		
8:		Material was buff colo	red.	
TES	ST METHOD			
1.	TESTING LABORA	ATORY: Texas Research I	nstitute, 9063 Bee	Caves Road, Austin,
2.		HOD: Continuous photo	<u>ionization detectio</u>	n with a 11.7 eV lam
3.		22-25 C		
<b>4. 5.</b>				
		ONS: 2 inch cell was	used. / Detector Tem	nerature = 60C.
Ĭ.		M ASTH F739 NETHOD: FT		
CHA	allenge Chemical	. 1	: COMPONENT 2	: 3
1.	CHEM NAME(s):	: Methylene Chloride	: : N/A	: ************************************
2.	CAS NUMBER (s):	75-09-2	N/A	N/A
	CONC. (IF MIX		: N/A	: N/A
4.	CHEMICAL SOUR	CE: <u>Fisher Pesticide</u> Grade	N/A N/A	N/A N/A
TFS	T RESULTS	Grade	·N/A	
2. 3. 4. 5.	BREAKTHROUGH TI	LES TESTED: One (Run I IME: 50.4 min. LIMIT 0.13 ppm. ERMEATION RATE _964 ug/ SS: 17-19 mil		
	TIME	: CONCENTRATION	: CONCENTRATION	: CONCENTRATION
	2.		:	
	3	<u> </u>	<u> </u>	
	5:	:	<del></del>	<u> </u>
	6.	:		:
	7.	:	•	:
	8.	•		
	9.			<u> </u>
	10	•		<u> </u>
	10			

### Run II

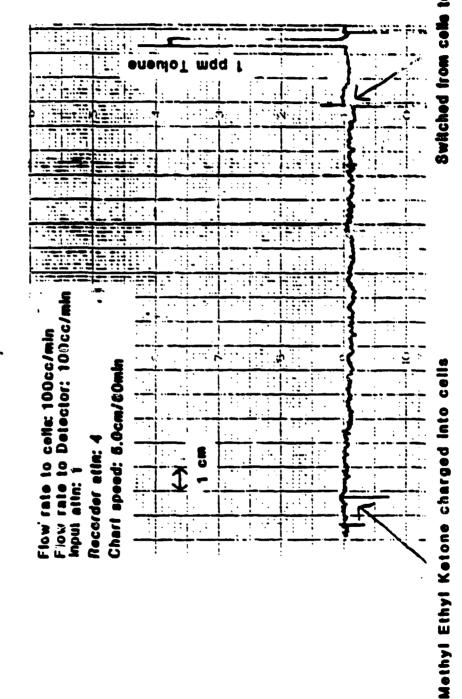


3:	PROTECTIVE MATER CONDITION BEFORE	IAL CODE: 068 TEST: Unused, no vi	sible imperfections	
4:				<del></del>
5:		CATION: Challenge 510	00	
	LOT OR MANUFACTU	RER DATE: N/A		
7:	NOMINAL THICKNESS	s: 15-20 mil		
8:	DESCRIPTION: Ma	terial was buff color	ea	
TES	ST METHOD			
1.	TESTING LABORATO	RY: Texas Research Ins	stitute, 9063 Bee Ca	ves Road, Austin, ?
		D: Continuous photoic	onization detection i	with a 11.7 eV lamp
3.	TEMPERATURE: 22-1			
Ψ.	COLLECTION SYSTEM	M: N2		
6.	OTHER CONDITIONS	: 2 inch cell was us	sed. / Detector Temper	rature = 60C.
. J.	DEVIATIONS FROM	ASTM F739 METHOD: FTO	w rate to cell was 90	oc/min.
CHA	ALLENGE CHEMICAL	1 :	COMPONENT 2	3
		Methylene Chloride	N/A	N/A
۲.	CAS NUMBER(s): CONC. (IF NIX)	/5-U9- <u>/</u>	N/A N/A	N/A N/A
4.	CHEMICAL SOURCE:		N/A	N/A
•		grade :	N/A	N/A
TES		•		
1. 2. 3. 4. 5.	BREAKTHROUGH TIME MIN DETECTABLE LII STEADY STATE PERM	TESTED: One (Run II) : 55.2 min MIT 0.17 ppm. EATION RATE 1.27 ug/ci 17-19 mil		
1. 2. 3. 4. 5.	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LII STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME:	TESTED: One (Run II) : 55.2 min MIT 0.17 ppm. EATION RATE 1.27 ug/ci 17-19 mil		: CONCENTRATION
1. 2. 3. 4. 5.	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LII STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME::	TESTED: One (Run II) : 55.2 min MIT 0.17 ppm. EATION RATE 1.27 ug/cr 17-19 mil	hour hour	CONCENTRATION
1. 2. 3. 4. 5.	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LII STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME:	TESTED: One (Run II) : 55.2 min MIT 0.17 ppm. EATION RATE 1.27 ug/cr 17-19 mil	hour hour	CONCENTRATION
1. 2. 3. 4. 5.	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LII STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME:  1. : 2. : 3. : 4. :	TESTED: One (Run II) : 55.2 min MIT 0.17 ppm. EATION RATE 1.27 ug/cr 17-19 mil	hour hour	CONCENTRATION
1. 2. 3. 4. 5.	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LII STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: : : : : : : : : : : : : : : : : : :	TESTED: One (Run II) : 55.2 min MIT 0.17 ppm. EATION RATE 1.27 ug/cr 17-19 mil	hour hour	CONCENTRATION
1. 2. 3. 4. 5.	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LII STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1. :: 2. :: 3. :: 4. :: 5. :: 6. ::	TESTED: One (Run II) : 55.2 min MIT 0.17 ppm. EATION RATE 1.27 ug/cr 17-19 mil	hour hour	CONCENTRATION
1. 2. 3. 4. 5.	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LII STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME:  1. :: 2. :: 3. :: 4. :: 5. :: 6. :: 7. ::	TESTED: One (Run II) : 55.2 min MIT 0.17 ppm. EATION RATE 1.27 ug/cr 17-19 mil	hour hour	CONCENTRATION
1. 2. 3. 4. 5.	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LII STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1. :: 2. :: 3. :: 4. :: 5. :: 6. :: 7. :: 8. ::	TESTED: One (Run II) : 55.2 min MIT 0.17 ppm. EATION RATE 1.27 ug/cr 17-19 mil	hour hour	CONCENTRATION
1. 2. 3. 4. 5.	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LII STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME:  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	TESTED: One (Run II) : 55.2 min MIT 0.17 ppm. EATION RATE 1.27 ug/cr 17-19 mil	hour hour	CONCENTRATION
1. 2. 3. 4. 5.	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LII STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1. :: 2. :: 3. :: 4. :: 5. :: 6. :: 7. :: 8. ::	TESTED: One (Run II) : 55.2 min MIT 0.17 ppm. EATION RATE 1.27 ug/cr 17-19 mil	hour hour	CONCENTRATION
1. 2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LII STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME:  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	TESTED: One (Run II): 55.2 min MIT 0.17 ppm. EATION RATE 1.27 ug/ci 17-19 mil NTS  CONCENTRATION	hour hour	CONCENTRATION



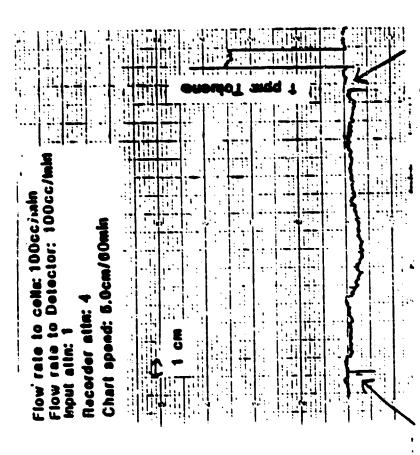
1.	DESCRIBITOR OF SKOPOCI EASTONIES		
	1: TYPE:_Teflon laminated Nomex		
	2: PROTECTIVE MATERIAL CODE: 068		
	3: CONDITION BEFORE TEST: Unused, no vis	ible imperfections	
	4: MANUFACTURER: Chemfab Corp.	·	
	5: PRODUCT IDENTIFICATION: Challenge 510	)0	
	6: LOT OR MANUFACTURER DATE: N/A		
	7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange cold		the second second
	other side.	Ted on one side at	id buil colored on the
2.	TEST METHOD		
	1. TESTING LABORATORY: Texas Research Ins	titute, 9063 Bee (	aves Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous photoic	nization detection	with a 11.7 eV Tamp.
	3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: No		
	4. COLLECTION MEDIUM: No. 5. COLLECTION SYSTEM: No.		
	6. OTHER CONDITIONS: 1 inch cells were	sed. / Detector Ten	merature = 50C.
	7. DEVIATIONS FROM ASTM F739 METHOD: Flow	rate to cells was	100cc/min.
3.	CHALLENGE CHEMICAL 1 :	COMPONENT 2	3
	1. CHEM NAME(s): Methyl Ethyl Ketone:	X/A	:N/A
	2. CAS NUMBER(s): 78-93-3	N/A	: N/A
	3. CONC. (IF MIX) N/A	N/A	:N/A
	4. CHEMICAL SOURCE: Baker reagent grade:	N/A	:N/A
	1. DATE TESTED:  2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was  4. MIN DETECTABLE LIMIT 0.65ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 17-19 mil.  7. SELECTED DATA POINTS N/A		nours.
	TIME : CONCENTRATION	: CONCENTRATION	: CONCENTRATION
	1:	<del></del>	<del>:</del>
	3.	<u></u>	
	4.	<u> </u>	<del></del> -
	5. :	•	:
	6.		•
	7.	:	
	8	<u>:</u>	<u>:</u>
	9.	<del>!</del>	
	10:	<u>.                                    </u>	<u> </u>
	8. OTHER OBSERVATIONS:		
<b>5.</b>	Source of DATA Samples were run by Sylvia Coo	oper on June 18, 19	986

### Chemical Resistance Testing of USCG Material with Methyl Ethyl Ketone



	4: 5:	PRODUCT IDENT	Chemfab Corp. IFICATION: Challe	nge 51,00	
		LOI UR MANUFA	ACTURER DATE: N/A CNESS: 15-20 mil		
	7: 8:	DESCRIPTION.	Material was oran	e colored on one side	and buff colored on
	٥.	other side.	MECET TET WES CHETT	e corored on one side	THE DOTT COLOTED ON
2.	TES	T METHOD			
	1.	TESTING LABOR	ATORY: Texas Resear	rch Institute, 9063 Be	e Caves Road, Austin,
	2. 3.	TEMPERATURE:	22_25 °C	photoionization detect	TON WITH & II./ EV I di
	4.	COLLECTION ME	DYUM: No		
	5.	COLLECTION SY	STEM: No		<del></del>
				were used. / Detector T	emperature = 60C.
	7.			: Flow rate to cells	
٥.	CHAL	LLENGE CHEMICA	1	: COMPONENT 2	: 3
	1_	CHEM NAME (s)	:Methyl Isobutyl Ke	etone: N/A	: N/A
		CAS NUMBER(s)		: N/A	N/A
	3.	CONC. (IF MIX	N/A	: N/A	: N/A
	4.	CHEMICAL SOUR	CE: Aldrich	: N/A	: N/A
_		T RESULTS	Reagent Grade	: N/A	: N/A
	6. 5	SAMPLE THICKNE SELECTED DATA			
		TIME	: CONCENTRAT	TION : CONCENTRATION	ON : CONCENTRATION
	•	1	:	:	:
		2.		:	
		3		_	-
		3.			
		3 5 7.			
		3			
		3			
		3 5 7 8 10			
		THER OBSERVAT	IONS:		
			10NS:		
5.	8. (	OTHER OBSERVAT			986
5.	8. (	OTHER OBSERVAT		a Cooper on June 19, 1	986.
5.	8. (	OTHER OBSERVAT		a Cooper on June 19, 1	986.

### Chemical Resistance Testing of USCG Material with Methyl Isobutyl 'Ketone

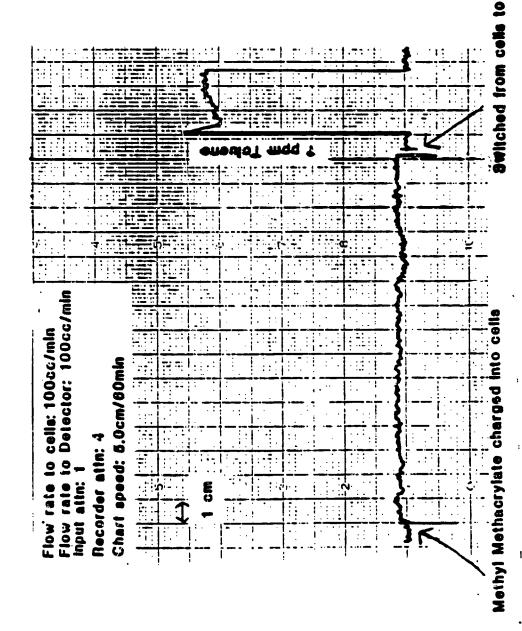


Methyl Isobutyl Ketone charged into cells

Iwitalish from colle to standard gas

C-17.

. 0	DESCRIPTION OF PRODUCT EVALUATED		
1	L: TYPE: Teffion Taminated Nomex		
	: PROTECTIVE MATERIAL CODE: 068		
3	: CONDITION BEFORE TEST: Unused, no v	isible imperfections	
4	: MANUFACTURER: Chemfab Corp.		
	5: PRODUCT IDENTIFICATION: Challenge 51	100	
	: LOT OR MANUFACTURER DATE: N/A		
	7: NOMINAL THICKNESS: 15-20 mil		
8	3: DESCRIPTION: Material was orange co other side.	lored on one side and	buff colored on the
T	TEST METHOD	·	
1	L. TESTING LABORATORY: Texas Research I	nstitute. 9063 Bee Ca	ves Road. Austin. TX
	2. ANALYTICAL METHOD: Continuous photo	ionization detection	with a 11.7 eV lamp.
	3. TEMPERATURE: 22-25°C		
	. COLLECTION MEDIUM: No		
	COLLECTION SYSTEM: N2		
	OTHER CONDITIONS: 1 inch cells were	e used. / Detector   em	perature = 60C.
•	L DEVIATIONS FROM ASTM F739 METHOD: _F	IOM LATE TO CELLE MAY	TOO EC/min.
C	CHALLENGE CHEMICAL 1	COMPONENT 2	: 3
1	L. CHEM NAME(s): Methyl Methacrylate:	N/A	:N/A
2	. CAS NUMBER(s): 80-62-6	N/A	N/A
3	. CONC. (IF MIX) N/A	N/A	N/A
	. CHEMICAL SOURCE: Aldrich reagent	. N/A	: N/A
T	EST RESULTS	N/A	: N/A
-	•		
	L. DATE TESTED: June 25, 1986	···	
	NUMBER OF SAMPLES TESTED: Three		
	3. BREAKTHROUGH TIME: No breakthrough wa 4. MIN DETECTABLE LIMIT .19 ppm	as observed after 3.1	nours.
	5. STEADY STATE PERMEATION RATE N/A		
	5. SAMPLE THICKNESS: 18-19 mil		····
	. SELECTED DATA POINTS N/A		
	TIME : CONCENTRATION	: CONCENTRATION	: CONCENTRATION
	2:		<u>:</u>
	3		
	<u> </u>	<del></del>	<u>:</u>
	6.	<u>·</u>	:
	Ž		•
	8.		•
	9:	:	:
	10	:	
^	OTHER ORCEDIATIONS		
Ö	3. OTHER OBSERVATIONS:		
S	OURCE OF DATA		
_	Samples were run by Sylvia Coope	r on June 25, 1986	



3:	PROTECTIVE MATERIA	L CODE: <u>068</u> EST: Unused, no vis	ible imperfections	
4:	MANUFACT URER: Che		The imperiections	<del></del>
<b>5</b> :	POODICT TOENTTETCA	TION: Challenge 510	0	
6:				
7:				
8:			red on one side and	d buff colored on th
٠.	other side.	Tal was orange core	71 Ed Oil 311E 311E 811	a but y coronea on ch
TE:	ST METHOD			
	TESTING LABORATORY	: Texas Research Ins	titute, 9063 Bee C.	aves Road, Austin, T
2.	ANALYTICAL METHOD:	Continuous photoic	nization detection	with a 10.2 eV lamp
3.	TEMPERATURE: 22-25			
	COLLECTION MEDIUM:			
5.	COLLECTION SYSTEM:	N <sub>2</sub>		
5.	OTHER CONDITIONS:	l inch cells were i	ised./ Detector Tem	perature = 60C.
7.	DEVIATIONS FROM AS	TM F739 METHOD: F16	w Tate to cells was	s 100cc/min.
CH	ALLENGE CHEMICAL	1 :	COMPONENT 2	3
1.	CHEM NAME(s): Me		N/A	: N/A
	CAS NUMBER(s): NA	<u> </u>	N/A	: N/A
3.		.0%	N/A	: N/A
4.	CHEMICAL SOURCE: MG	ricultural Supply :	N/A	: N/A
	ST RESULTS			
	DATE TESTED: Septem			
2.	NUMBER OF SAMPLES T			
	BREAKTHROUGH TIME:			
3.	MIN DETECTABLE LIMI	1 .15 psm		
3. 4.	MIN DETECTABLE LIMI			
3. 4. 5.	STEADY STATE PERMEA	TION RATE N/A		
3. 4. 5. 6.	STEADY STATE PERMEA SAMPLE THICKNESS: 1	TION RATE N/A 9-20 mil		
3. 4. 5. 6.	STEADY STATE PERMEA	TION RATE N/A 9-20 mil		
3. 4. 5. 6.	STEADY STATE PERMEA SAMPLE THICKNESS: 1 SELECTED DATA POINT TIME :	TION RATE N/A 9-20 mil	: CONCENTRATION	: CONCENTRATION
3. 4. 5. 6.	STEADY STATE PERMEA SAMPLE THICKNESS: 1 SELECTED DATA POINT  TIME:  1. ::::::::::::::::::::::::::::::::::	TION RATE N/A 9-20 mil S N/A	: CONCENTRATION	: CONCENTRATION
3. 4. 5. 6.	STEADY STATE PERMEA SAMPLE THICKNESS: 1 SELECTED DATA POINT TIME : 1.	TION RATE N/A 9-20 mil S N/A	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	: CONCENTRATION
3. 4. 5. 6.	STEADY STATE PERMEA SAMPLE THICKNESS: 1 SELECTED DATA POINT  TIME: 1. :: :: :: :: :: :: :: :: :: :: :: :: ::	TION RATE N/A 9-20 mil S N/A	: CONCENTRATION :	: CONCENTRATION
3. 4. 5. 6.	STEADY STATE PERMEA SAMPLE THICKNESS: 1 SELECTED DATA POINT  TIME: 1. :: :: :: :: :: :: :: :: :: :: :: :: ::	TION RATE N/A 9-20 mil S N/A	: CONCENTRATION : :	: CONCENTRATION
3. 4. 5. 6.	STEADY STATE PERMEA SAMPLE THICKNESS: 1 SELECTED DATA POINT  TIME: 1. : : : : : : : : : : : : : : : : : : :	TION RATE N/A 9-20 mil S N/A	: CONCENTRATION : :	CONCENTRATION
3. 4. 5. 6.	STEADY STATE PERMEA SAMPLE THICKNESS: 1 SELECTED DATA POINT  TIME: 1. : : : : : : : : : : : : : : : : : : :	TION RATE N/A 9-20 mil S N/A	CONCENTRATION  : : : : : : : :	CONCENTRATION
3. 4. 5. 6.	STEADY STATE PERMEA SAMPLE THICKNESS: 1 SELECTED DATA POINT  TIME: 1. : : : : : : : : : : : : : : : : : : :	TION RATE N/A 9-20 mil S N/A	: CONCENTRATION : : : : :	: CONCENTRATION
3. 4. 5. 6. 7.	STEADY STATE PERMEA SAMPLE THICKNESS: 1 SELECTED DATA POINT  TIME:  1. : : : : : : : : : : : : : : : : : : :	TION RATE N/A 9-20 mil S N/A CONCENTRATION	: : : : : :	: CONCENTRATION
3. 4. 5. 6. 7.	STEADY STATE PERMEA SAMPLE THICKNESS: 1 SELECTED DATA POINT  TIME: 1. : : : : : : : : : : : : : : : : : : :	TION RATE N/A 9-20 mil S N/A CONCENTRATION	: : : : : :	CONCENTRATION

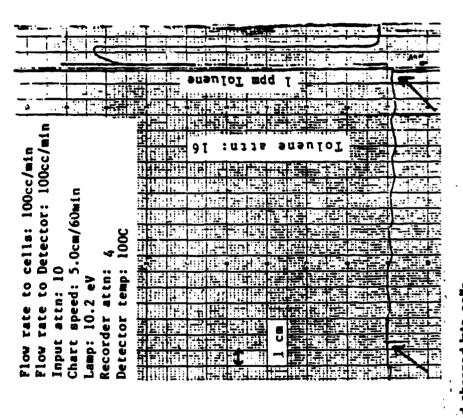
# Chemical Resistance Testing of USCG Material with Methyl Parathion

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Chart Lamp:	Ä	4 1			.1.	10.	1		77	157	1	1				1

Methyl Parathion charged into cells

. DE	ESCRIPTION OF PRODUCT EV	AL UATED			
1:					
2:					
3:			isible imperfection	ns	
4 : 5 :		N. Challenge 5	00		
6:		ATE: N/A	.00		
7:	: NOMINAL THICKNESS: 1	5-20 mil			
8:	: DESCRIPTION: <u>Materia</u> other side.	l was orange col	ored on one side	and buff co	olored on the
. TE	EST METHOD				•
1.		exas Research I:	nstitute, 9063 Bee	Caves Road	d. Austin. TX
2.	. ANALYTICAL METHOD: _C	ontinuous photo:	ionization detecti	on with a	0.20 eV lamp
3.	TEMPERATURE: 22-25°C				
	COLLECTION MEDIUM: N. COLLECTION SYSTEM: N				
	OTHER CONDITIONS: 1		used /Detector T	emperature.	= 1000
7.	DEVIATIONS FROM ASTM	F739 METHOD: FIG	w rate to cells w	as 100 cc/n	nin.
. CH	HALLENGE CHEMICAL	1	COMPONENT 2	•	3
1.	. CHEM NAME(s): Naled		11/3	:	N/A
	. CAS NUMBER(s): N/A		N/A		N/A
	CONC. (IF NIX) N/A		N/A	;	N/A
4.		·	N/A	:	N/A
. TE	EST RESULTS				, t
		10, 1986			
	. NUMBER OF SAMPLES TEST			77.	
	. BREAKTHROUGH TIME: No . MIN DETECTABLE LIMIT		observed after 3	.40 nours.	
5.	. STEADY STATE PERMEATIO	N RATE N/A			
6.	. SAMPLE THICKNESS: 19-2	O mil			<del></del>
	. SELECTED DATA POINTS _	N/A	····		
	TIME :	CONCENTRATION	: CONCENTRATIO	N : CONC	ENTRATION
	2.		·		
	3. <u> </u>		<del></del>	<del></del>	
	5.		:	<del></del> -	
	6.		:	:	
	7.		:	:	
	8:			<u>:</u>	
	10.		<u>.</u>	<del></del>	
	•		<u> </u>	<u></u>	
8.	OTHER OBSERVATIONS:				
SC	DURCE OF DATA	h Danda - 4 D -		1006	
	Samples were run	by Denise McDon	ald on October 10,	זאמף.	

## Chemical Resistance Testing of USCG Material with Naled

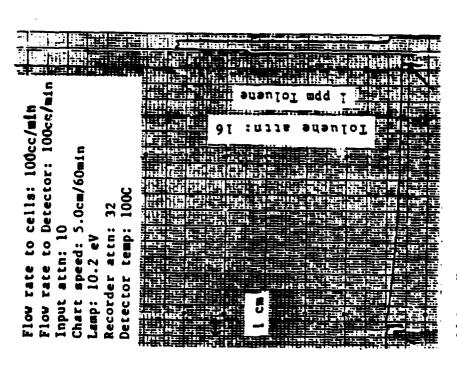


Naled charged into cells

	DESCRIPTION OF PRODUCT EVALUATION	•	
	1: TYPE: Teflon laminated Nom 2: PROTECTIVE MATERIAL CODE:		
	— · · · · · · · · · · · · · · · · · · ·	used, no visible imperfections	
	4: MANUFACTURER: Chemfab Cor		
	5: PRODUCT IDENTIFICATION: C	hallenge 5100	
	6: LOT OR MANUFACTURER DATE:		
	7: NOMINAL THICKNESS: 15-20 8: DESCRIPTION: Material was	orange colored on one side and buff co	lored on the
	other side.	ordinge corored on one side and but i co	STOPES OF SIE
•	TEST METHOD		
	1. TESTING LABORATORY: Texas	Research Institute, 9063 Bee Caves Road	d Austin TY
		uous photoionization detection with a	
	3. TEMPERATURE: 22-25°C		
	4. COLLECTION MEDIUM: N2		
	5. COLLECTION SYSTEM: No. 1 inch	cells were used. /Detector Temperature	= 100C
	7. DEVIATIONS FROM ASTM F739	METHOD: Flow rate to cells was 100 cc	min.
	CHALLENGE CHEMICAL 1	: COMPONENT 2 :	3
	9 Parma MANT/-\ No-bab-	:	A. /A
	1. CHEM NAME(s): Naphtha 2. CAS NUMBER(s): 8032-32-4	N/A	N/A N/A
	3. CONC. (IF MIX) N/A	: N/A :	N/A
	4. CHEMICAL SOURCE: Aldrich re		N/A
•	TEST RESULTS	::::	N/A
	1. DATE TESTED: September 24,	1006	
	2. NUMBER OF SAMPLES TESTED: T		
	3. BREAKTHROUGH TIME: No brea	kthrough was observed after 3.46 hours	•
	4. MIN DETECTABLE LIMIT 4.55 p		
	5. STEADY STATE PERMEATION RAT 6. SAMPLE THICKNESS: 19-20 mi		
	7. SELECTED DATA POINTS N/A		
		ENTRATION : CONCENTRATION : CONC	CENTRATION
	1. 2.		
	3.		
	4:	: : : : : : : : : : : : : : : : : : :	,
	5. :		
			<del></del>
	5:	:	
	7. 8.		
	7. : 8. : 9. :		
	7. 8.		
	7. : 8. : 9. : 10. :		
	7. : 8. : 9. :		
	7. : 8. : 9. : 10. :		

## Chemical Resistance Testing of USCG Material with Naphtha

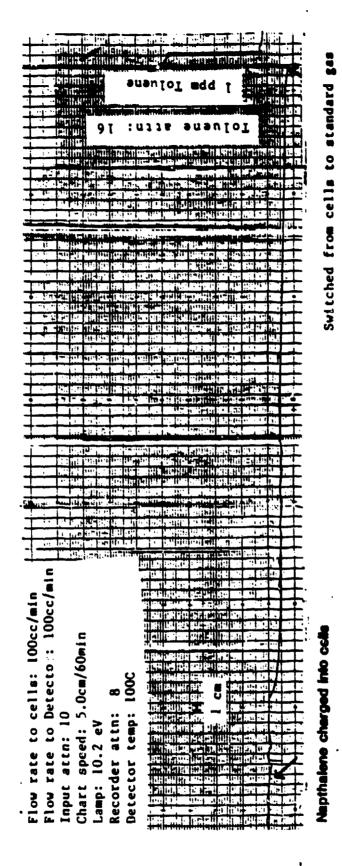
The second secon



Naphtha charged into cells

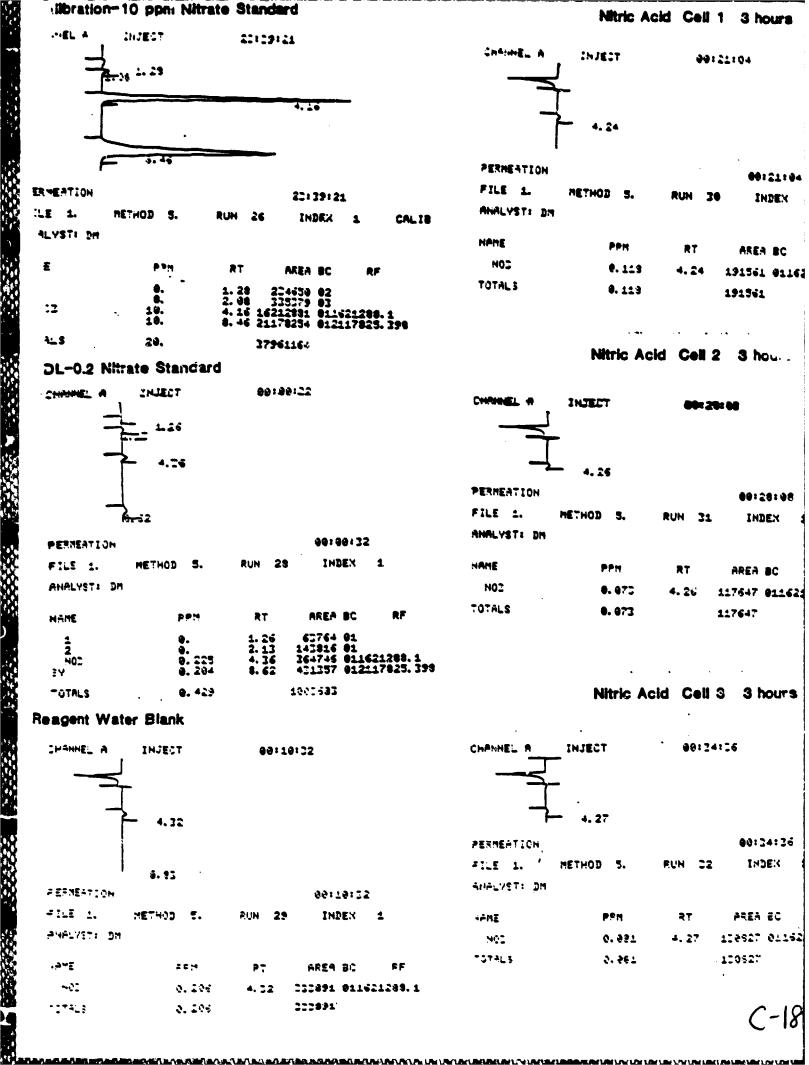
	3: CONDI 4: MANUF 5: PRODU 6: LOT (	ITION BEFOR FACTURER: JCT IDENTIF DR MANUFACT	RIAL CODE: 068 E TEST: Unused, no v Chemfab Corp. ICATION: Challenge 5. URER DATE: N/A		
	8: DESCR		SS: 15-20 mil aterial was orange co	lored on one side and	buff colored on
2.	TEST MET	100			
	2. ANALY	ING LABORAT TICAL METH ERATURE: 22	ORY: Texas Research I OD: Continuous photo	nstitute, 9063 Bee Ca ionization detection	ves Road, Austin with a 10.20 eV
	4. COLLE	CTION MEDI	UM: N2		
		CTION SYST	EM: N2 S: linch cells were	e used. /Detector Tem	perature = 100C.
			ASTM F739 METHOD: F	low rate to cells was	100 cc/min.
3.	CHALLENGE	CHEMICAL	1	COMPONENT 2	: 3 ·
			Napthal ene	N/A	N/A
	2. CAS ! 3. CONC.	NUMBER(s): . (IF MIX)	91-20-3 N/A	N/A N/A	N/A N/A
	4. CHEMI	CAL SOURCE	:Aldrich reagent	N/A	N/A
	TEST RESU		grade	N/A	N/A
	5. STEADY	Y STATE PER	IMIT .01 ppm as Benze MEATION RATE N/A . 19-20 mil INTS N/A	ne	
		TIME	: CONCENTRATION	: CONCENTRATION	: CONCENTRATIO
	•		<u>:</u>	•	<u>:</u>
	1. —	· · · · · · · · · · · · · · · · · · ·	•	•	
	1. <u></u>		:		•
	3. <u> </u>				:
					: :
	3				
	3. <u> </u>				
	3				
	3	OBSERVATIO	NS:		
5.	3	DATA			
5.	3	DATA	NS:		86.

Chemical Resistance Testing of USCG Maferial with Napthalene

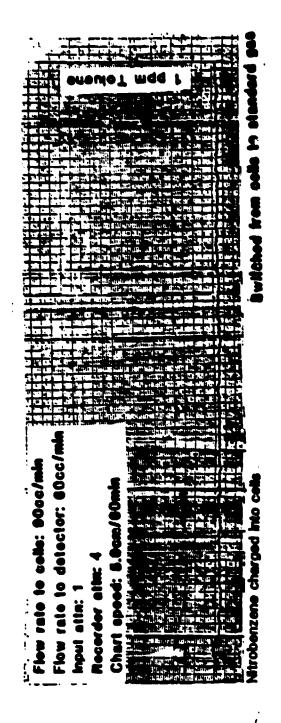


1.	DESCRIPTION OF PRODUCT EVALUATED	
	1: TYPE: Teflon laminated Nomex	
	2: PROTECTIVE MATERIAL CODE: 068	
	3: CONDITION BEFORE TEST: Unused, no	visible imperfections
	4: MANUFACTURER: Chemfab Corp.	
	5: PRODUCT IDENTIFICATION: Challenge	5100
	6: LOT OR MANUFACTURER DATE: N/A	
	7: NOMINAL THICKNESS: 15-20 mil	
	8: DESCRIPTION: <u>Material was orange</u> other side.	colored on one side and buff colored on the
2.	TEST METHOD	
	1. TESTING LABORATORY: Texas Research	Institute, 9063 Bee Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Ion Chromatograp	phy on Dionex 2000.
	3. TEMPERATURE: Ambient	
	4. COLLECTION MEDIUM: Aqueous	
	5. COLLECTION SYSTEM: Aqueous	
	6. OTHER CONDITIONS: 2 inch cells were	e used.
	7. DEVIATIONS FROM ASTM F739 METHOD:	
3.	CHALLENGE CHEMICAL 1	: COMPONENT 2 : 3
	1. CHEM NAME(s): Nitric Acid	N/AN/A
	2. CAS NUMBER(s): 7697-37-2	N/A N/A
	3. CONC. (IF MIX) 70%	N/A N/A
	4. CHEMICAL SOURCE: Mallinckrodt	: N/A : N/A
4.	1. DATE TESTED: <u>September 11</u> , <u>1986</u> . 2. NUMBER OF SAMPLES TESTED: <u>Three</u>	
	3. BREAKTHROUGH TIME: N/A	
	4. MIN DETECTABLE LIMIT 0.2 ppm	
	5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil	
	7. SELECTED DATA POINTS cell 1,2, and	3 at end of 3 hour test
	The second secon	y de cita of a float seas
	TIME : CONCENTRATION  1. 3 hours : <0.2 ppm	: CONCENTRATION : CONCENTRATION : <0.2 ppm : <0.2 ppm
	2	
	3	
	4	
	5 6. :	
	ή; <del></del>	
	8.	
	9.	
	10.	
		,
	8. OTHER OBSERVATIONS: Retention time 4.16 minutes	for 10ppm Nitrate calibration standard was
_		
5.	SOURCE OF DATA  Samples were run by Denise McDo	nald on September 11. 1986.
	Campings were real and a contract the state of	THE THE PERSON OF THE PERSON O

CONTROL PROPERTY



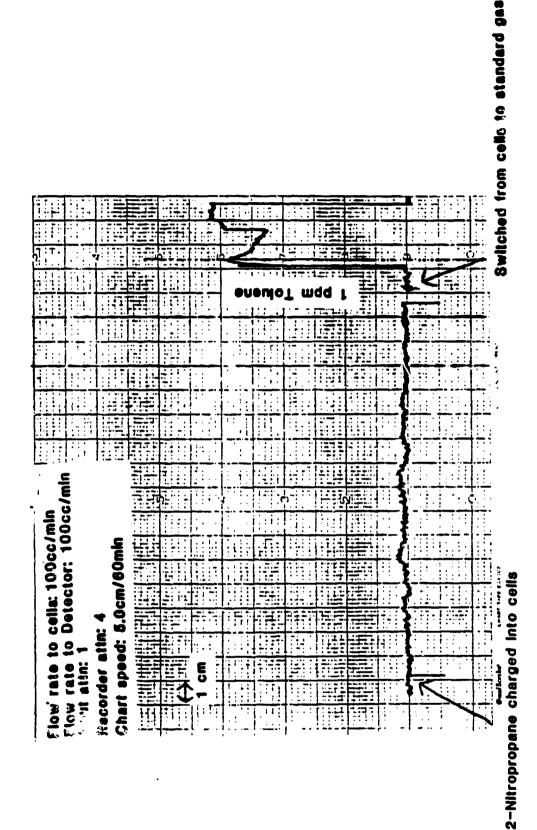
•	DESCRIPTION OF	PRODUCT EVALUATED		,
	1: TYPE: Teflo	n laminated Nomex		
	2: PROTECTIVE	MATERIAL CODE: 068		
	3: CONDITION B	EFORE TEST: Unused, r	no visible imperfections	
	4: MANUFACTURE	R: Chemfab Corp.		
	5: PRODUCT IDE	NT IFICATION: Challeng	e 5100	
	5: LOT OR MANUI	FACTURER DATE: N/A		
		CKNESS: 15-20 mil		
	B: DESCRIPTION	: Material was buff o	colored	<del></del>
	TEST METHOD			
	1. TESTING LABO	ORATORY: Texas Researc	ch Institute, 9063 Bee Cav	ves Road, Austin, TX
	Z. ANALYTICAL I	METHOD: Continuous ph	notoionization detection w	with a 11.7 eV lamp.
	3. TEMPERATURE	: 22-25°C		
	4. COLLECTION I	MEDIUM: N2		
	. COLLECTION S	SYSTEM: N2		
1	OTHER CONDI	TIONS: 2 inch cells w	were used. / Detector Tempe	erature = 60C.
•	- DEVIATIONS	from astn f739 nethod:	Flow rate to cells was	90 cc/min.
ı	CHALLENGE CHEMIC	CAL 1	: COMPONENT 2 :	3
•	. CHEM NAME (S	): <u>Nitrobenzene</u>	N/A	N/A
j	. CAS NUMBER (	s): 98-95-3	: N/A :	N/A
	CONC. (IF M	IX) N/A	: N/A :	N/A
•	. CHEMICAL SOL	URCE: Mallinckrodt	: N/A :	N/A
	EST RESULTS	reagent grade	: N/A :	N/A
	2. NUMBER OF SAM 3. BREAKTHROUGH 4. MIN DETECTABM	TIME: No breakthrou LE LIMIT PERMEATION RATE N/A NESS: 17-19 mil	igh was observed after 3 h	iours.
	TIME	: CONCENTRATI	ON : CONCENTRATION :	CONCENTRATION
	2.			
	4.	•		<del></del>
	5.		<del></del>	
	6.		·	· ————————————————————————————————————
	7.		<del></del>	
	8.		<u>-</u>	
	9.		•	
	10.	:		
5		ATIONS:	· · · · · · · · · · · · · · · · · · ·	- <del> </del>
•	- OTHER OBSERVA	11000.		
c	DIDLE DE DATA			
S	OURCE OF DATA	are run hu Kamen Veren	thoor on April 9, 1986.	



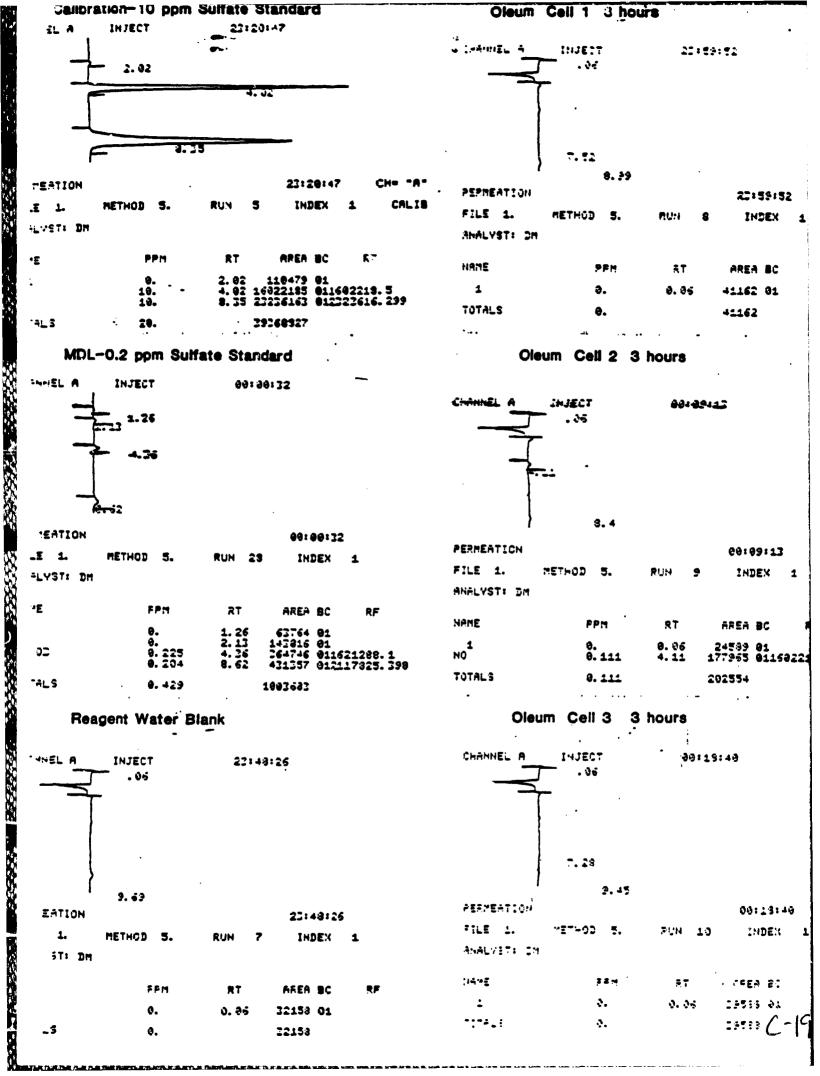
1.	DESCRIPTION OF PRODUCT	EVALUATED		
	1: TYPE: Teflon lamina	ited Nomex		
	2: PROTECTIVE MATERIAL	CODE: 068		
	3: CONDITION BEFORE TE	ST: Unused, no vis	ible imperfections	
	4: MANUFACTURER: Chem			
	5: PRODUCT IDENTIFICAT 6: LOT OR MANUFACTURER	DATE N/A	<u>U</u>	
	7: NOMINAL THICKNESS:			<del></del>
	8: DESCRIPTION: Mater	ial was orange cold	red on one side and	buff colored on the
	other side.			
2.	TEST METHOD			
	1. TESTING LABORATORY:	Toxas Research Inc	tituta 9063 Rea Car	ves Road, Austin, TX
				with a 11.70 eV lamp.
	3. TEMPERATURE: 22-25°	C		
	4. COLLECTION MEDIUM:			
	5. COLLECTION SYSTEM: 6. OTHER CONDITIONS:	N2	used Metector Temp	50C
	7. DEVIATIONS FROM AST	M F739 METHOD: Flo	w rate to cells was	100 cc/min.
_				
7	CHALLENGE CHEMICAL	1 :	COMPONENT 2 :	3
	1. CHEM NAME(s): 2-N	iitrooroossa :	N/A	N/A
	1. CHEM NAME(s): 2-N 2. CAS NUMBER(s): 79-	46-9 :	N/A	N/A
	3. CONC. (IF MIX) N/A	:	N/A	N/A
	4. CHEMICAL SOURCE: Koc	lak reagent grade :	N/A	N/A
4.	TEST RESULTS			
•••				
	1. DATE TESTED: July 8	1986		
	2. NUMBER OF SAMPLES TE 3. BREAKTHROUGH TIME: N			<del></del>
	4. MIN DETECTABLE LIMIT			
	5. STEADY STATE PERMEAT	ION RATE N/A		
	6. SAMPLE THICKNESS: 18			
	7. SELECTED DATA POINTS	N/A		
	TIME :	CONCENTRATION	: CONCENTRATION	CONCENTRATION
	1:		:	
	2:			
	4.		<u> </u>	
	5			
	6			
	7. 8.			
	9.		<u> </u>	
	10.		•	
	<del></del>			·
	8. OTHER OBSERVATIONS:	<del></del>		
	<del></del>	<del></del>		
5.	SOURCE OF DATA			
-		by Sylvia Cooper o	on July 8, 1986.	

# Chemical Resistance Testing of USCG Materlal with 2-Nitropropane

CONTROL DESCRIPTION OF THE PROPERTY OF THE PRO



4	: CONDITION BEFORE TEST: Unused, no vi : MANUFACTURER: Chemfab Corp. : PRODUCT IDENTIFICATION: Challenge 51		
	LOT OR MANUFACTURER DATE: N/A		
	: NOMINAL THICKNESS: 15-20 mil		
8	3: DESCRIPTION: <u>Material was orange col</u> other side.	ored on one side and	buff colored on t
T	EST METHOD		
	. TESTING LABORATORY: Texas Research Ir		es Road, Austin,
_	. ANALYTICAL METHOD: Ion Chromatography	on Dionex 2000.	
	TEMPERATURE: Ambient		
	COLLECTION MEDIUM: Aqueous COLLECTION SYSTEM: Aqueous		<del></del>
6	OTHER CONDITIONS: 2 inch cells were	head	
	DEVIATIONS FROM ASTM F739 NETHOD:	03641	
C	HALLENGE CHEMICAL 1	COMPONENT 2 :	3
	. CHEM NAME(s): Oleum	N/A	N/A
1	. CHEM NAME(S): UTESHI	17/71	
1 2	. CAS NUMBER(s): 8014-95-7		N/A
2	CAS NUMBER(s): 8014-95-7 CONC. (IF MIX) 20% S03	N/A N/A	N/A
2 3 4 T	CAS NUMBER(s): 8014-95-7  CONC. (IF MIX) 20% S03  CHEMICAL SOURCE: Fisher  EST RESULTS  DATE TESTED: September 22, 1986.	N/A	
2 3 4 T 1 2 3 4 5	CAS NUMBER(s): 8014-95-7  CONC. (IF MIX) 20% S03  CHEMICAL SOURCE: Fisher  EST RESULTS  DATE TESTED: September 22, 1986.  NUMBER OF SAMPLES TESTED: Three  B. BREAKTHROUGH TIME: No breakthrough was  MIN DETECTABLE LIMIT 0.2 ppm  S. STEADY STATE PERMEATION RATE N/A	N/A N/A N/A	N/A N/A
2 3 4 T 1 2 3 4 5 6	CAS NUMBER(s): 8014-95-7  CONC. (IF MIX) 20% S03  CHEMICAL SOURCE: Fisher  EST RESULTS  DATE TESTED: September 22, 1986.  NUMBER OF SAMPLES TESTED: Three  B. BREAKTHROUGH TIME: No breakthrough was  MIN DETECTABLE LIMIT 0.2 ppm	N/A N/A N/A s observed after 3 hou	N/A N/A
2 3 4 T 1 2 3 4 5 6	CAS NUMBER(s): 8014-95-7  CONC. (IF MIX) 20% S03  CHEMICAL SOURCE: Fisher  EST RESULTS  DATE TESTED: September 22, 1986.  NUMBER OF SAMPLES TESTED: Three  B. BREAKTHROUGH TIME: No breakthrough was  MIN DETECTABLE LIMIT 0.2 ppm  STEADY STATE PERMEATION RATE N/A  S. SAMPLE THICKNESS: 19-20 mil  SELECTED DATA POINTS cell 1,2, and 3	N/A N/A N/A s observed after 3 hou	N/A N/A
2 3 4 T 1 2 3 4 5 6	CAS NUMBER(s): 8014-95-7  CONC. (IF MIX) 20% S03  CHEMICAL SOURCE: Fisher  EST RESULTS  DATE TESTED: September 22, 1986.  NUMBER OF SAMPLES TESTED: Three  B. BREAKTHROUGH TIME: No breakthrough was  MIN DETECTABLE LIMIT 0.2 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 19-20 mil  SELECTED DATA POINTS cell 1,2, and 3 an	N/A N/A N/A N/A  s observed after 3 hour test : CONCENTRATION	N/A N/A N/A
2 3 4 T 1 2 3 4 5 6	CAS NUMBER(s): 8014-95-7  CONC. (IF MIX) 20% S03  CHEMICAL SOURCE: Fisher  EST RESULTS  DATE TESTED: September 22, 1986.  NUMBER OF SAMPLES TESTED: Three  BREAKTHROUGH TIME: No breakthrough was  MIN DETECTABLE LIMIT 0.2 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 19-20 mil  SELECTED DATA POINTS cell 1,2, and 3	N/A N/A N/A N/A  s observed after 3 hour test : CONCENTRATION	N/A N/A N/A
234 T 123456	CAS NUMBER(s): 8014-95-7  CONC. (IF MIX) 20% S03  CHEMICAL SOURCE: Fisher  EST RESULTS  DATE TESTED: September 22, 1986.  NUMBER OF SAMPLES TESTED: Three  BREAKTHROUGH TIME: No breakthrough was  MIN DETECTABLE LIMIT 0.2 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 19-20 mil  SELECTED DATA POINTS cell 1,2, and 3	N/A N/A N/A N/A  s observed after 3 hour test : CONCENTRATION	N/A N/A N/A
234 T 123456	CAS NUMBER(s): 8014-95-7  CONC. (IF MIX) 20% S03  CHEMICAL SOURCE: Fisher  EST RESULTS  DATE TESTED: September 22, 1986.  NUMBER OF SAMPLES TESTED: Three  BERAKTHROUGH TIME: No breakthrough was  MIN DETECTABLE LIMIT 0.2 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 19-20 mil  SELECTED DATA POINTS cell 1,2, and 3	N/A N/A N/A N/A  s observed after 3 hour test : CONCENTRATION	N/A N/A N/A
234 T 123456	CAS NUMBER(s): 8014-95-7  CONC. (IF MIX) 20% S03  CHEMICAL SOURCE: Fisher  EST RESULTS  DATE TESTED: September 22, 1986.  NUMBER OF SAMPLES TESTED: Three  BREAKTHROUGH TIME: No breakthrough was  MIN DETECTABLE LIMIT 0.2 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 19-20 mil  SELECTED DATA POINTS cell 1,2, and 3	N/A N/A N/A N/A  s observed after 3 hour test : CONCENTRATION	N/A N/A N/A
234 T 123456	CAS NUMBER(s): 8014-95-7 CONC. (IF MIX) 20% S03 CHEMICAL SOURCE: Fisher  EST RESULTS  DATE TESTED: September 22, 1986. NUMBER OF SAMPLES TESTED: Three B. BREAKTHROUGH TIME: No breakthrough was MIN DETECTABLE LIMIT 0.2 ppm S. STEADY STATE PERMEATION RATE N/A S. SAMPLE THICKNESS: 19-20 mil V. SELECTED DATA POINTS cell 1,2, and 3 a	N/A N/A N/A N/A  s observed after 3 hour test : CONCENTRATION	N/A N/A N/A
234 T 123456	CAS NUMBER(s): 8014-95-7  CONC. (IF MIX) 20% S03  CHEMICAL SOURCE: Fisher  EST RESULTS  DATE TESTED: September 22, 1986.  NUMBER OF SAMPLES TESTED: Three  BREAKTHROUGH TIME: No breakthrough was  MIN DETECTABLE LIMIT 0.2 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 19-20 mil  SELECTED DATA POINTS cell 1,2, and 3	N/A N/A N/A N/A  s observed after 3 hour test : CONCENTRATION	N/A N/A N/A
234 T 123456	CAS NUMBER(s): 8014-95-7 CONC. (IF MIX) 20% S03 CHEMICAL SOURCE: Fisher  EST RESULTS  DATE TESTED: September 22, 1986. NUMBER OF SAMPLES TESTED: Three B. BREAKTHROUGH TIME: No breakthrough was MIN DETECTABLE LIMIT 0.2 ppm S. STEADY STATE PERMEATION RATE N/A S. SAMPLE THICKNESS: 19-20 mil V. SELECTED DATA POINTS cell 1,2, and 3 a	N/A N/A N/A N/A  s observed after 3 hour test : CONCENTRATION	N/A N/A N/A
234 T 1234567	CAS NUMBER(s): 8014-95-7  CONC. (IF MIX) 20% S03  CHEMICAL SOURCE: Fisher  EST RESULTS  DATE TESTED: September 22, 1986.  NUMBER OF SAMPLES TESTED: Three  BREAKTHROUGH TIME: No breakthrough was  MIN DETECTABLE LIMIT 0.2 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 19-20 mil  TIME : CONCENTRATION  1. 3 hours : <0.2 ppm  2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	N/A N/A N/A  N/A  s observed after 3 hour test  concentration  co.2 ppm	N/A N/A N/A CONCENTRATION <0.2 ppm
234 T 1234 567	CAS NUMBER(s): 8014-95-7  CONC. (IF MIX) 20% S03  CHEMICAL SOURCE: Fisher  EST RESULTS  DATE TESTED: September 22, 1986.  NUMBER OF SAMPLES TESTED: Three  BREAKTHROUGH TIME: No breakthrough was  MIN DETECTABLE LIMIT 0.2 ppm  STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 19-20 mil  SELECTED DATA POINTS cell 1,2, and 3	N/A N/A N/A  N/A  s observed after 3 hour test  concentration  co.2 ppm	N/A N/A N/A CONCENTRATION <0.2 ppm



	1: TYPE: Teflon la			
	2: PROTECTIVE MATE	RIAL CODE: 068		
	3: CONDITION BEFOR	E TEST: Unused, no vi	sible imperfections	
	4: MANUFACTURER:			
		ICATION: <u>Challenge 51</u>	00	
	6: LOT OR MANUFACT			
	7: NOMINAL THICKNE			
	8: DESCRIPTION: M	aterial was orange col	ored on one side and	buff colored on the
	other side.			
•	TEST METHOD			
	1. TESTING LABORAT	ORY: Texas Research In	stitute, 9063 Bee Ca	ves Road, Austin, TX
	2. ANALYTICAL METH	OD: Continuous photoi	onization detection	with a 10.2 eV lamp.
	3. TEMPERATURE: 22			
	4. COLLECTION MEDI			
	5. COLLECTION SYST			
	6. OTHER CONDITION	S: 1 inch cells were	used./ Detector Temp	erature = 100C.
4	Y - PEATWATONZ EKOM	ASTM F739 NETHOD: F1	ow rate to cells was	100 cc/min.
. (	CHALLENGE CHEMICAL	1 :	COMPONENT 2	3
	1. CHEM NAME(s):		W/A	N/A
		N/A	N/A	N/A
	3. CONC. (IF MIX)	45.07%	N/A	: N/A
4	4. CHEMICAL SOURCE	:Agricultural Supply:	N/A	N/A
1	TEST RESULTS			
	TEST RESULTS  1. DATE TESTED: Sep  2. NUMBER OF SAMPLES  3. BREAKTHROUGH TIM  4. MIN DETECTABLE L  5. STEADLY STATE PERI	S TESTED: Three E: N/A IMIT .09 ppm MEATION RATE N/A		
	1. DATE TESTED: Sep 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PERI 6. SAMPLE THICKNESS	S TESTED: Three E: N/A IMIT .09 ppm MEATION RATE N/A : 19-20 mil		
	1. DATE TESTED: Sep 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PERI 6. SAMPLE THICKNESS 7. SELECTED DATA PO	S TESTED: Three E: N/A IMIT .09 ppm MEATION RATE N/A : 19-20 mil INTS N/A		
	1. DATE TESTED: Sep 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PERI 6. SAMPLE THICKNESS 7. SELECTED DATA PO	S TESTED: Three E: N/A IMIT .09 ppm MEATION RATE N/A : 19-20 mil	: CONCENTRATION	: CONCENTRATION
	1. DATE TESTED: Sep 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PERI 6. SAMPLE THICKNESS 7. SELECTED DATA PO TIME 1.	S TESTED: Three E: N/A IMIT .09 ppm MEATION RATE N/A : 19-20 mil INTS N/A	: CONCENTRATION	: CONCENTRATION
	1. DATE TESTED: Sep 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE L 5. STEADY STATE PERI 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME 1. 2.	S TESTED: Three E: N/A IMIT .09 ppm MEATION RATE N/A : 19-20 mil INTS N/A	: CONCENTRATION	CONCENTRATION
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	1. DATE TESTED: Sep 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE L 5. STEADY STATE PERI 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME 1. 2. 3. 4. 5. 6. 7.	S TESTED: Three E: N/A IMIT .09 ppm MEATION RATE N/A : 19-20 mil INTS N/A	CONCENTRATION	CONCENTRATION
	1. DATE TESTED: Sep 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE L 5. STEADY STATE PERI 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME 1. 2. 3. 4. 5. 6. 7. 8.	S TESTED: Three E: N/A IMIT .09 ppm MEATION RATE N/A : 19-20 mil INTS N/A	CONCENTRATION	CONCENTRATION
	1. DATE TESTED: Sep 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME 4. MIN DETECTABLE L 5. STEADY STATE PERI 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME 1. 2. 3. 4. 5. 6. 7.	S TESTED: Three E: N/A IMIT .09 ppm MEATION RATE N/A : 19-20 mil INTS N/A	: CONCENTRATION	CONCENTRATION
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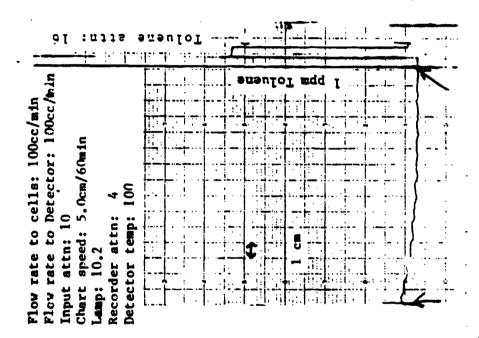
Chemical Resistance Testing of USCG Material with Parathion

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Parathton charged into cells

	1. T	FSTING LABORA	TORY: Texas Researc	h Institute, 9063 Be	e Caves Road. A	lustin.
	2. A		HOD: Continuous ph	otoionization detect		
		OLLECTION MED				
		OLLECTION SYS				200
				were used./Detector Flow rate to cells		
٥.	CHALL	ENGE CHEMICAL	1	: COMPONENT 2	:	3
		HEM NAME (s):		: N/A		1/A
	2. C	AS NUMBER(s):	N/A	:N/A		V/A
		ONC. (IF MIX) HEMICAL SOURC		: N/A : N/A		N/A N/A
	2 NH		ptember 25, 1986	·····		
	3. BR 4. MI 5. ST 6. SA	MBER OF SAMPL EAKTHROUGH TI N DETECTABLE	ES TESTED: Three ME: No breakthrou LIMIT .02 as Benze RMEATION RATE N/A S: 19-20 mil	gh was observed afte ne	r 3 hours.	
	3. BR 4. MI 5. ST 6. SA	MBER OF SAMPL EAKTHROUGH TI N DETECTABLE EADY STATE PE MPLE THICKNES	ES TESTED: Three ME: No breakthrou LIMIT .02 as Benze RMEATION RATE N/A S: 19-20 mil	ne		TRATION
	3. BR 4. MI 5. ST 6. SA	MBER OF SAMPL EAKTHROUGH TI N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P	ES TESTED: Three ME: No breakthrou LIMIT .02 as Benze RMEATION RATE N/A S: 19-20 mil OINTS N/A	ne		TRATION
	3. BR 4. MI 5. ST 6. SA 7. SE	MBER OF SAMPL EAKTHROUGH TI N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P  TIME	ES TESTED: Three ME: No breakthrou LIMIT .02 as Benze RMEATION RATE N/A S: 19-20 mil OINTS N/A	ne		TRATION
	3. BR 4. MI 5. ST 6. SA 7. SE	MBER OF SAMPL EAKTHROUGH TI N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P	ES TESTED: Three ME: No breakthrou LIMIT .02 as Benze RMEATION RATE N/A S: 19-20 mil OINTS N/A	ne		TRATION
	3. BR 4. MI 5. ST 6. SA 7. SE	MBER OF SAMPL EAKTHROUGH TI N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P  TIME	ES TESTED: Three ME: No breakthrou LIMIT .02 as Benze RMEATION RATE N/A S: 19-20 mil OINTS N/A	ne		TRATION
	3. BR 4. MI 5. ST 6. SA 7. SE 1. 2. 3. 4. 5.	MBER OF SAMPL EAKTHROUGH TI N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P  TIME	ES TESTED: Three ME: No breakthrou LIMIT .02 as Benze RMEATION RATE N/A S: 19-20 mil OINTS N/A	ne		TRATION
	3. BR 4. MI 5. ST 6. SA 7. SE 1. 2. 3. 4. 5.	MBER OF SAMPL EAKTHROUGH TI N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P  TIME	ES TESTED: Three ME: No breakthrou LIMIT .02 as Benze RMEATION RATE N/A S: 19-20 mil OINTS N/A	ne		TRATION
	3. BR 4. MI 5. ST 6. SA 7. SE 1. 2. 3. 4. 5.	MBER OF SAMPL EAKTHROUGH TI N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P  TIME	ES TESTED: Three ME: No breakthrou LIMIT .02 as Benze RMEATION RATE N/A S: 19-20 mil OINTS N/A	ne		TRATION
	3. BR 4. MI 5. ST 6. SA 7. SE 1. 2. 3. 4. 5. 6. 7. 8.	MBER OF SAMPL EAKTHROUGH TI N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P  TIME	ES TESTED: Three ME: No breakthrou LIMIT .02 as Benze RMEATION RATE N/A S: 19-20 mil OINTS N/A  : CONCENTRATI : : : : : :	ON : CONCENTRATI		TRATION
	3. BR 4. MI 5. ST 6. SA 7. SE 1. 2. 3. 4. 5. 6. 7. 8.	MBER OF SAMPL EAKTHROUGH TI N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P  TIME	ES TESTED: Three ME: No breakthrou LIMIT .02 as Benze RMEATION RATE N/A S: 19-20 mil OINTS N/A  : CONCENTRATI : : : : : :	ON : CONCENTRATI		TRATION
	3. BR 4. MI 5. ST 6. SA 7. SE 1. 2. 3. 4. 5. 6. 7. 8.	MBER OF SAMPL EAKTHROUGH TI N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P  TIME	ES TESTED: Three ME: No breakthrou LIMIT .02 as Benze RMEATION RATE N/A S: 19-20 mil OINTS N/A  : CONCENTRATI : : : : : :	ON : CONCENTRATI		TRATION

### Chemical Resistance Testing of USCG Material with PCBs



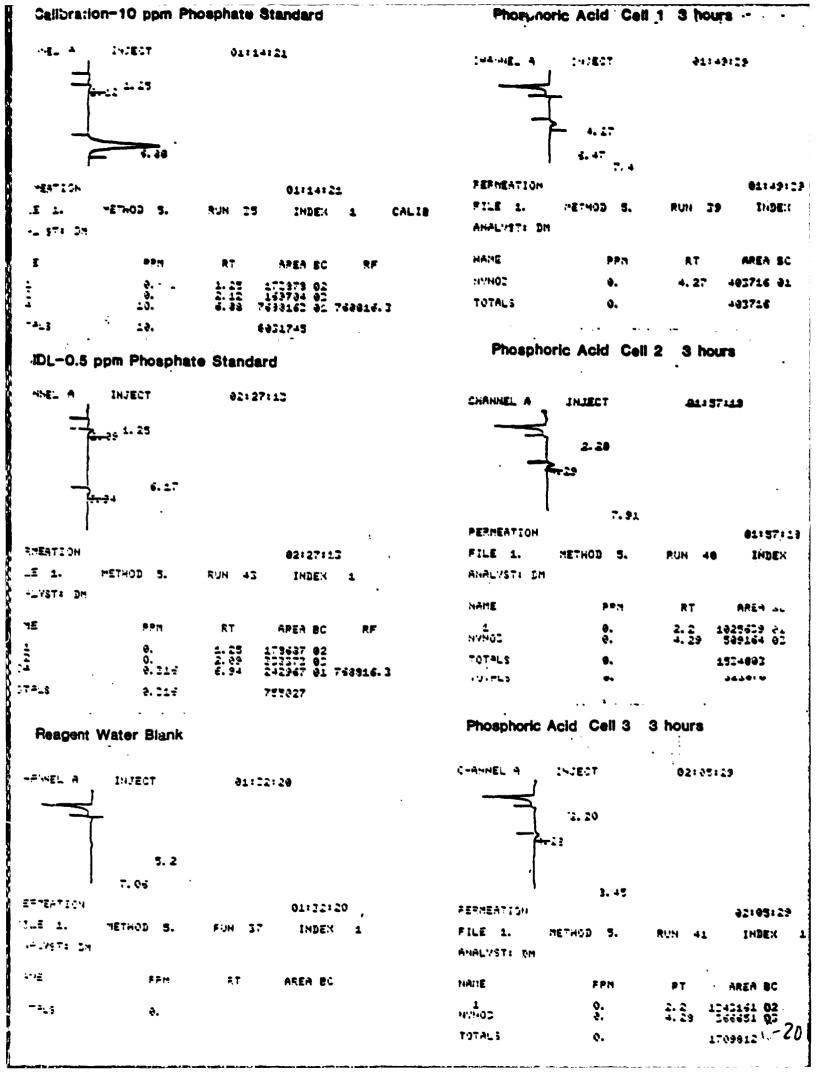
PCBs charged into cells

1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 008 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NONLINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was buff colored  2. TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin. 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV 1/3 3. TEMPERATURE: 22-25°C 4. COLLECTION MODIUM: N2 5. COLLECTION SYSTEM: N2 6. GTHER CONDITIONS: 2 inch cells were used./ Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 90 cc/min  3. CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME (s): Phenol : N/A : N/A 2. CAS MUMBER (s): Phenol : N/A : N/A : N/A 3. CUNC. (IF MIX) 85% (115 HgO) : N/A : N/A : N/A 4. CHEMICAL SOURCE: Mallinckroot : N/A : N/A : N/A 4. CHEMICAL SOURCE: Mallinckroot : N/A : N/A : N/A 4. TEST RESULTS  1. DATE TESTED: April 8, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: NO. breakthrough was observed after 3 hours. 4. MIN DETECTABLE I.MIT : O.30 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS : 17-19 mil 7. SELECTED DATP POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : 2. : : : : : : : : : : : 3. : : : : : : : : : : : : 4. : : : : : : : : : : : : : : : 5. : : : : : : : : : : : : : : : : 7. : : : : : : : : : : : : : : : : : : 9. : : : : : : : : : : : : : : : : : : :	1.	DESCRIPTION OF	PRODUCT E	EVALUATED			
3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was buff colored  2. TEST METHOD- 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin. 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV 1/3 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION NEDIUM: N2 6. OTHER COMBITIONS: Z inch cells were used./ Detector Temperature = 60°C. 7. DEVIATIONS FROM ASTM F/39 METHOD: Flow tette to cells was 90°Cc/min  3. CHALLENGE CHEMICAL 1							
4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: MOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was buff colored  2. TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV 1/3 and trical method: N/A 1. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N/A 5. COLLECTION SYSTEM: N/A 6. OTHER CONDITIONS: 2 Inch cells were used./ Detector Temperature = 60°C. 7. DEVIATIONS FROM ASTM F/39 METHOD: Flow Table to cells was 90°Cc/min 3. CHALLENGE CHEMICAL 1: CHAPTOMENT 2: 3 1. CHEM NAME(s): Phenol : N/A : N/A 2. CAS MUMBER(s): 108-95-2 : N/A : N/A : N/A 3. CONC. (IF MIX) 89% (11% H/A) : N/A : N/A 4. CHEMICAL SOURCE: Mallinckroot : N/A : N/A : N/A 4. CHEMICAL SOURCE: Mallinckroot : N/A : N/A : N/A 4. TEST RESULTS 1. DATE TESTED: April 8, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT 0.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :					no visible	imperfections	
6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was buff colored  2. TEST METHOD- 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV 12 in		4: MANUFACTURE		ab Corp.			
7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was buff colored  2. TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV 12 mil 2. TEMPERATURE: 22-25 C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. GTHER CANDITIONS: 2 inch cells were used./ Detactor Temperature = 60C. 7. DEVIATIONS PROM ASTM F739 METHOD: Flow waste to cells was 90 cc/min  3. CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Phenol : N/A : N/A 2. CAS MUMBER(s): 108-95-2 : N/A : N/A : N/A 4. CHEMICAL SOURCE: Mallinckroot : N/A : N/A : N/A 4. TEST RESULTS 1. DATE TESTED: April 8. 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT 0.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :					ge 2100		
2. TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV 13. TEMPERATURE: 22-25°C  4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 2 inch cells were used./ Detector Temperature = 60°C. 7. DEVIATIONS FROM ASTM F/39 METHOD: Flow rate to cells was 90° cc/min  3. CHALLENGE CHENICAL 1 = COMPONENT 2 : 3 1. CHEM NAME(s): Phenol : N/A : N/A 2. CAS NUMBER(s): 108-95-2 : N/A : N/A : N/A 3. CONC. (IF MIX) B93 (113 H20) : N/A : N/A : N/A 4. CHEMICAL SOURCE: MAITINCKTOCT : N/A : N/A : N/A 4. TEST RESULTS  1. DATE TESTED: April 8. 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT 0.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :		7: NOMINAL TH			2010000		
1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin. 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV 16 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: No. 5. COLLECTION SYSTEM: No. 6. GIMER CONDITIONS: 2 inch cells were used./ Detector Temperature = 50°C. 7. DEVIATIONS FROM ASIM F739 METHOD: Flow rate to cells was 90° cc/min  3. CHALLENGE CHEMICAL 1: LOMPOMENT 2: 3 1. CHEM NAME(s): Phenol : N/A : N/A 2. CAS **MAMBER(s): 108-95-2 : N/A : N/A 3. CONC. (IF MIX): B9% (11% H00): N/A : N/A : N/A 4. CHEMICAL SOURCE: Mallinckroot : N/A : N/A : N/A 7. TEST RESULTS 1. DATE TESTED: April 8, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT 0.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :		o. DESCRIPTION	N. FIECE	al was buil	Colored		
2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV 13 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: No. 5. COLLECTION SYSTEM: No. 6. OTHER CONDITIONS: 2 inch cells were used./ Detector Temperature = 60°C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 90° cc/min  3. CHALLENGE CHEMICAL 1: COMPONENT 2: 3 1. CHEM NAME(s): Phenol : N/A : N/A : N/A 2. CAS NUMBER(s): 108-95-2 : N/A : N/A : N/A 3. CONC. (IF MIX) 89% (11% H20) : N/A : N/A : N/A : N/A 4. CHEMICAL SOURCE: Mallinckroot : N/A : N/A : N/A : N/A : N/A 4. TEST RESULTS  1. DATE TESTED: April 8, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT 0.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :	2.	TEST METHOD-					
3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. GTHER CONDITIONS: 2 Inch cells were used. Detector Temperature = 60°C. 7. DEVIATIONS FROM ASTM F/39 METHOD: Flow rate to cells was 90° cc/min  3. CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Phenol : N/A : N/A 2. CAS NUMBER(s): 108-95-2 : N/A : N/A 4. CHEMICAL SOURCE: Mallinckroot : N/A : N/A 4. CHEMICAL SOURCE: Mallinckroot : N/A : N/A 4. TEST RESULTS  1. DATE TESTED: April 8, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT 0.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION: 2. : : : : : 3. : : : : : 4. : : : : : : : 9. : : : : : : : 10. : : : : : : : : : 10. : : : : : : : : : : 10. : : : : : : : : : : : 10. : : : : : : : : : : : 10. : : : : : : : : : : : : 10. : : : : : : : : : : : : : : 10. : : : : : : : : : : : : : : : 10. : : : : : : : : : : : : : : : : : 10. : : : : : : : : : : : : : : : : : : :							
4. COLLECTION MEDIUM: No 5. COLLECTION SYSTEM: No 6. OTHER COMPITIONS: 2 inch cells were used./ Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F/39 METHOD: Flow Fate to cells was 90 cc/min 3. CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3 1. CHEM NAME(s): Phenol : N/A					hotoionizat	ion detection w	ith a 11.7 eV Ta
6. OTHER CONDITIONS: 2 inch cells were used.   Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 90 cc/min  3. CHALLENGE CHEMICAL		4. COLLECTION	MEDIUM:	N <sub>2</sub>			
7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 90 cc/min  3. CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3  1. CHEM NAME(s): Phenol : N/A					ere used /	Detactor Temper	ature = 500
1. CHEM NAME(s): Phenol: N/A N/A N/A   2. CAS NUMBER(s): 108-95-2		7. DEVIATIONS	FROM AST	F739 METHOD	Flow Tat	e to cells was	90 cc/min
2. CAS NUMBER(\$): 108-95-2 : N/A : N/A 3. CONC. (IF MIX) 89% (11% Hp0) : N/A : N/A 4. CHEMICAL SOURCE: Mallinckroot : N/A : N/A : N/A reagent grade : N/A : N/A 4. TEST RESULTS  1. DATE TESTED: April 8, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT 0.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :	3.	CHALLENGE CHEM	ICAL	1	: COM	PONENT 2 :	3
3. CONC. (IF MIX) 89% (11% H20) : N/A : N/						:	
4. CHEMICAL SOURCE: MalTinckroot : N/A : N/A reagent grade : N/A : N/A N/A  4. TEST RESULTS  1. DATE TESTED: April 8, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours.  4. MIN DETECTABLE LIMIT 0.03 ppm 5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : :		2. GAS NUMBER				<u></u> :	
1. DATE TESTED: April 8, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT 0.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :		4. CHEMICAL S	DURCE: Ma	Tinckroat	: N/A		N/A
2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT 0.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :	4.	TEST RESULTS	rei	agent grade	:N/A	•	N/A
2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT 0.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : : : : : : : : : : : : : : : : : :		1 DATE TESTED	. Anmil S	1086			
3. BREAKTHROUGH TIME: No breakthrough was observed after 3 hours. 4. MIN DETECTABLE LIMIT 0.03 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION 1. : : : : : : 2. : : : : : : : : 3. : : : : : : : : 4. : : : : : : : : : 5. : : : : : : : : : 6. : : : : : : : : : 7. : : : : : : : : : : 8. : : : : : : : : : : 10. : : : : : : : : :  8. OTHER OBSERVATIONS:							
5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION  1. : : : : : : : : : : : : : : : : : : :		3. BREAKTHROUG	H TIME: NO	breakthrough	h was obser	ved after 3 hou	rs.
6. SAMPLE THICKNESS: 17-19 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION  1. : : : : : : : : : : : : : : : : : : :		5. STEADY STAT	F PERMEAT	O.U.S ppm ON RATE N/A			
TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION :		6. SAMPLE THICK	KNESS: 17	7-19 mil			
1.		7. SELECTED DA	TA POINTS	N/A			
9. : : : : : : : : : : : : : : : : : : :		TIME	:	CONCENTRAT	ION : C	ONCENTRATION :	CONCENTRATION
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8. OTHER OBSERVATIONS:  5. SOURCE OF DATA					:		
5. SOURCE OF DATA		10	<del>:</del>			<u>:</u>	<del></del>
5. SOURCE OF DATA Samples were run by Karen Verschoor on April 8, 1986		8. OTHER OBSER	VATIONS: _	<del></del>			
Samples were run by Karen Verschoor on April 8, 1986	5.	SOURCE OF DATA					· · · · · · · · · · · · · · · · · · ·
		Samples	were run	by Karen Ver	schoor on A	pril 8, 1986	·

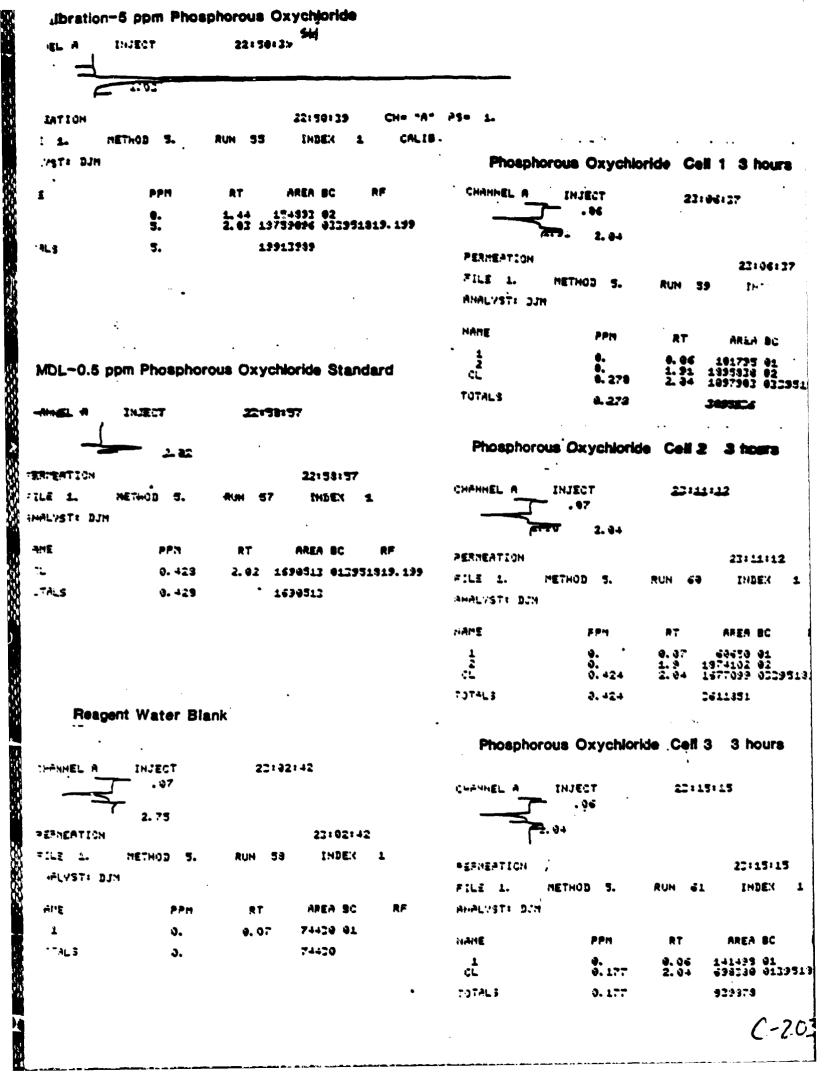
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Phenol charged into cella

. 1	DESCRIPTION OF PRODUCT EVALUATED
	: TYPE: Teflon laminated Nomex : PROTECTIVE MATERIAL CODE: 068
	: CONDITION BEFORE TEST: Unused, no visible imperfections
	: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100
	: PRODUCT IDENTIFICATION: Challenge 5100 : LOT OR MANUFACTURER DATE: N/A
	: NOMINAL THICKNESS: 15-20 mil
	3: DESCRIPTION: Material was orange colored on one side and buff colored on the
	other side.
1	TEST METHOD
1	. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
	TEMPERATURE: Ambient
4	. COLLECTION MEDIUM: Aqueous
•	COLLECTION SYSTEM: Aqueous
	OTHER CONDITIONS: 2 inch cells were used.  DEVIATIONS FROM ASTM F739 METHOD:
: <b>(</b>	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
1	. CHEM NAME(s): Phosphoric Acid : N/A : N/A
4	. CAS NUMBER(s): 7664-38-2 : N/A : N/A
	CONC. (IF MIX) 85% N/A N/A N/A N/A N/A
1	EST RESULTS
•	DATE TESTED. Santambar 20, 1006
3	DATE TESTED: September 29, 1986 NUMBER OF SAMPLES TESTED: Three
	B. BREAKTHROUGH TIME: N/A
4	. MIN DETECTABLE LIMIT 0.5 ppm
	S. STEADY STATE PERMEATION RATE N/A S. SAMPLE THICKNESS: 19-20 mil.
	. SELECTED DATA POINTS Cell 1,2, and 3 at end of three hour test
•	
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
	1. 3 hours : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm : <0.5 ppm
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8	3. OTHER OBSERVATIONS: Retention time for 10ppm phosphate calibration standard w
	6.88 minutes.
5	OURCE OF DATA
	Samples were run by Denise McDonald September 29, 1986.



1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex
	2: PROTECTIVE MATERIAL CUDE: 068
	3: CONDITION BEFORE TEST: Unused, no visible imperfections
	4: MANUFACTURER: Chemfab Corp.
	5: PRODUCT IDENTIFICATION: Challenge 5100
	6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil
	8: DESCRIPTION: Material was orange colored on one side and buff colored on the
	other side.
_	
2.	TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Ion Chromatography on Dionex 2000.
	3. TEMPERATURE: Ambient
	4. COLLECTION MEDIUM: Aqueous
	5. COLLECTION SYSTEM: Aqueous 6. OTHER CONDITIONS: 2-inch cells were used.
	7. DEVIATIONS FROM ASTN F739 NETHOD:
	TO LETERING THE POINT TO PETITO.
3.	CHALLENGE CHEMICAL 1' : COMPONENT 2 : 3
	1. CHEM NAME(s): Phosphorous Dxychle: N/A
	ride N/A : N/A
	2. CAS NUMBER(s): 10025-87-3 : N/A : N/A
	3. CONC. (IF MIX) 99% : N/A : A/A
	4. CHEMICAL SOURCE: Alrich : N/A : N/A
4.	TEST RESULTS  1. DATE TESTED: October 7, 1986
	2. NUMBER OF SAMPLES TESTED: Three
	3. BREAKTHROUGH TIME: No breakthrough observed after 3 hours.
	4. MIN DETECTABLE LIMIT 0.5 ppm
	5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mils
	7. SELECTED DATA POINTS Cells 1,2, and 3 after 15 minutes and at end of 3 hour test.
	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
	1. 15 minutes: 0.5 ppm (.204): 0.5 ppm (.516): 0.5 ppm (.217)
	2. 3 hours : <0.5 ppm (.278) : <0.5 ppm (.424): <0.5 ppm (.177) 3. : : :
	3
	5.
	6.
	7
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	8. OTHER OBSERVATIONS: Retention time for Phophorous Oxychloride standard was 2.03
	minutes. Fifteen minute samples were run to establish chloride background
	levels within each cell.
5.	SOURCE OF DATA
	Samples were rin by Denise McDonald on October 7, 1986.

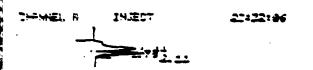


1.	DESCRIPTION OF PRODUCT EVALUATED  1: TYPE: Teflon laminated Nomex		
	2: PROTECTIVE MATERIAL CUDE: 068		
	3: CONDITION BEFORE TEST: Unused, no v	isible imperfections	
	4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5	100	
	6: LOT OR MANUFACTURER DATE: N/A		
	7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange co	lored on one side and	buff colored in the
	other side.	TOTES ON ONE SIDE ENG	butt corored on the
2.	TEST METHOD		
	1. TESTING LABORATORY: Texas Research I	nstitute, 9063 Bee Cav	ves Road, Austin, TX
	2. ANALYTICAL METHOD: Ion Chromatograp	hy on Dionex 2000.	
	3. TEMPERATURE: Ambient 4. COLLECTION MEDIUM: Aqueous		<del></del>
	5. COLLECTION SYSTEM: Aqueous		
	6. OTHER CONDITIONS: 2 inch cells were	used.	
	7. DEVIATIONS FROM ASTM F739 METHOD:	<del> </del>	
3.	CHALLENGE CHEMICAL 1	: COMPONENT 2	3 :
	1. CHEM NAME(s): Phosphorous Trichie-		N/A
	2. CAS NUMBER(s): 7719-12-2	N/A N/A	N/A N/A
	3. CONC. (IF MIX) N/A	N/A	N/A
	4. CHEMICAL SOURCE: Aldrich	: N/A	N/A
4.	TEST RESULTS		
	1 DATE TESTED OF A SHARP NO 1000		
	1. DATE TESTED: September 30, 1986. 2. NUMBER OF SAMPLES TESTED: Three		
	3. BREAKTHROUGH TIME: No breakthrough w	as observed after 3 ho	ours.
	4. MIN DETECTABLE LIMIT 0.5 ppm		
	5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil		
	7. SELECTED DATA POINTS Cell 1,2, and 3	at end of three hour	test.
	TIME : CONCENTRATION	: CONCENTRATION :	CONCENTRATION
	1. 3 hours : <0.2 ppm	: 40.2 ppm	: <0.2 ppm
	2. :		
	3	•	
	5		
	6. :	:	
	8.	•	
	9	. ,	
	10:		
	8. OTHER OBSERVATIONS: Retention time f	or 5 ppm Phosphorous 1	[richloride
	calibration standard was 2.11 mi	iin rez.	
5.	SOURCE OF DATA Samples were run by Denise McD	oneld on Contembor 20	1086
	Samples were run by Denise MCD	onard on September 30	, 1700.

### libration-5 ppm Phosphorous Trichloride -MNE'L 4 INJECT 22:23:31

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RAEĂLION			20:29:0	1 CH= "A
_E 1.	NET-100 5.	RUN 36	INDEX	1 CALI
יבעיפר: BJI	M			
475	PPM	RT	arga ac	RF
1	e. 5.	1.41 2.11 17	593300 01 208766 013	441 <b>75</b> 2 <b>.</b> 199
TOTALS	5.	17	39586	
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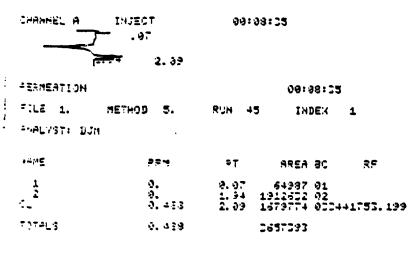
### MDL-0.5 ppm Phosphorous Trichloride Standard



AZZUZA LIVN	•		XZX	51.46	
FILE 1.	METHOD 5.	RUN E	7 INI	E:	1
ANALYST: DJM					
MAME	PPM	RT	AREA	BC	RF
<u>:</u> در	ə. ə. 9. 501	1.44 1.75 2.11	499615 1161659 2171547	92244 92 92	1757. 199
TOTALS .	0. 531		6925332		

### Reagent Water Blank

TETTON



### Phosphorous Trichloride Cell 1 3 hours

CHANNEL A	INJECT 97 	23:56	2:23
PERMEATION			23:50:29
FILE 1.	METHGD 5.	RUN 41	INDEK 1
ANALYST: DJM			
HAME	PPM	RT	AREA BC
1 2	ą. 2	9. 97	36473 81
<b>a</b> _	0. 731		373492 937441 <u>~</u> 373492 92
TOTALS	9. 221	2	954481

### Phosphorous Trichloride Cell 2 3 >

23:54:41

3712558

CHANNEL A INJECT

	2. 33			
HOITEBASE			20:54:4	1
FILE 1.	METHOD 5.	RUN 4	2 INDEK	1
ANALYST: D	JM			
HAME	pec.	RT	AREA GC	ţ
1 2 CL	રુ. રુ. રુ. 432	0. 37 1. 34 2. 09	37603 01 2015702 02 1660257 027	

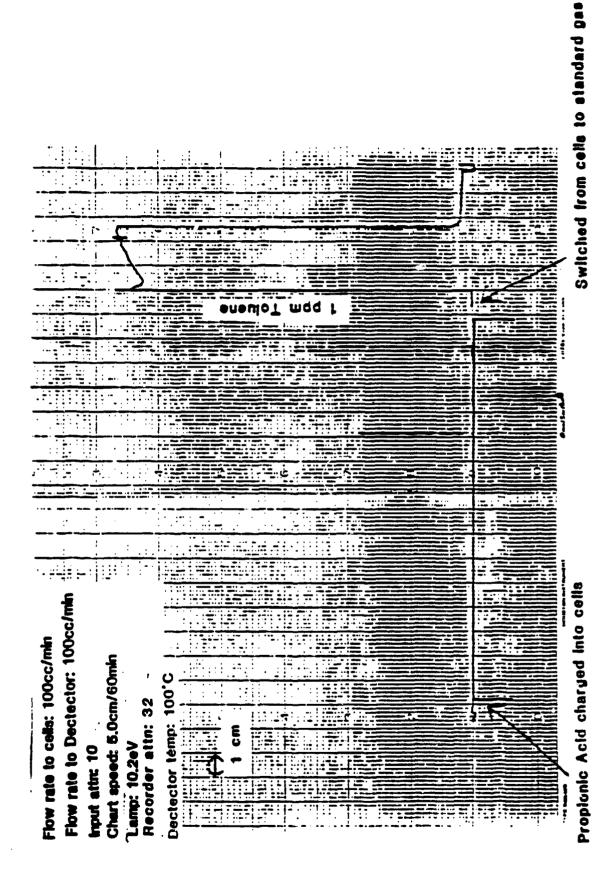
### Phosphorous Trichloride Cell 3 3 hours

a. 432

CHANNEL A	INJECT . 07	99:92:15		
	<b>=</b> 2.08			
PERMEATION		99:03:15		
FILE 1.	MET400 5.	RUN 44	INDEK 1	
AMALYST: DJ	ĸ			
NAME	Pen	RT	AREA 20 RF	
CL	9. 9. 267	0. 97 2. 08	44443 01 913636 013441753	
TOTALS	9. 267		364129 (-205	

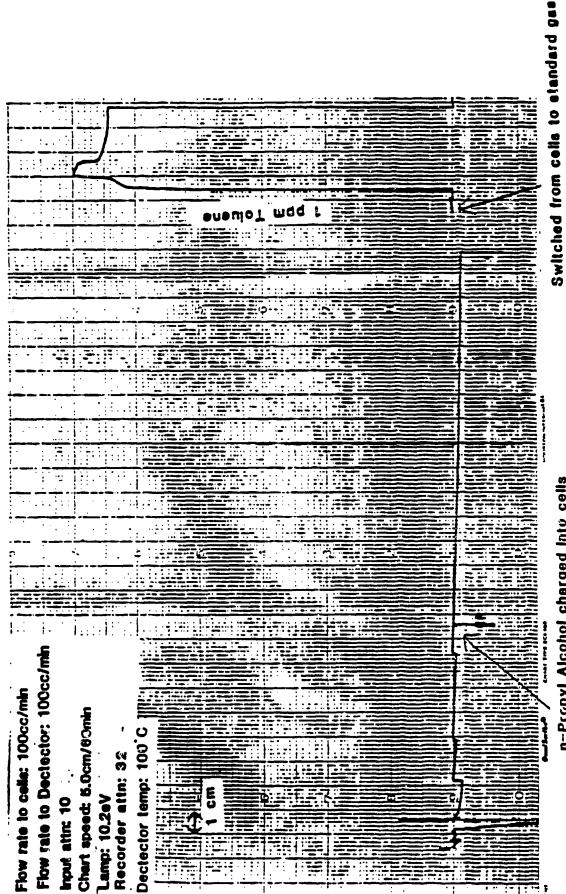
1.	DESCRIPTION OF P	ESCRIPTION OF PRODUCT EVALUATED						
	1: TYPE: Teflor	laminated Nomex		•				
	2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST. Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A							
		KNESS: 15-20 mil						
		Material was orange	colored on one sid	le and buff (	colored on the			
	other side.	·						
2.	TEST METHOD							
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp. 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2							
			ere used./Detector	Temperatur	=100C.			
	6. OTHER CONDITIONS: 1 inch cells were used./Detector Temperature =100C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 100 cc/min.							
		CAL 1	: COMPONENT 2		3			
3.	CHALLENGE CHEMIC	.AL I	: COMPONENT 2	•	3			
	1. CHEM NAME(s)	): Propionic Acid	: N/A	ŏ	N/A			
	2. CAS NUMBER(		-: N/A		N/A			
	3. CONC. (IF M	•	-: N/A	;	N/A			
		RCE:Aldrich reagent		;	N/A			
		grade	N/A	:	N/A			
4.	TEST RESULTS	<u> </u>		<del></del>				
			•					
	1. DATE TESTED:							
		2. NUMBER OF SAMPLES TESTED: Three						
		TIME: No breakthrough	h was observed afte	er 3 hours.				
	4. MIN DETECTABI		<del></del>		<del></del>			
	-	PERMEATION RATE N/A						
	6. SAMPLE THICKNESS: 18-19 mil 7. SELECTED DATA POINTS N/A							
	/- SELECTED DATA	A POINTS N/A			<del></del>			
	TIME	: CONCENTRATIO	ON : CONCENTRAT	rion : co	NCENTRATION			
	1.	<u> </u>	:					
	2.		<u>:</u>	<u>-</u>				
	3	<del></del>	<del></del>					
	5	<del></del>	<del></del>	<del></del>				
	6.	•	<del></del>	<u>-</u>	<del></del>			
	ÿ: ———	<del></del>		:				
	8.	:	<u> </u>	:	<del></del>			
	9.	:	:	:	<del></del>			
	10.	:	:	:				
	•							
	8. OTHER OBSERVATIONS:							
_								
5.	SOURCE OF DATA			0.4				
	Samples v	were run by Sylvia Coo	per on July 25, 19	50				

A TOTAL STATE OF THE PROPERTY



1.	DESCRIPTION OF PRODUCT EVALUATED		
	1: TYPE: Teflon laminated Nomex		
	2: PROTECTIVE MATERIAL CODE: 068		
	3: CONDITION BEFORE TEST: Unused, no	visible imperfection	15
	4: MANUFACTURER: Chemfab Corp.		
	5: PRODUCT IDENTIFICATION: Challenge	5100	
	6: LOT OR MANUFACTURER DATE: N/A		
	7: NOMINAL THICKNESS: 15-20 mil		
	8: DESCRIPTION: Material was orange c	olored on one side	ind buff colored on the
	other side.		
2.	TEST METHOD	•	
	1. TESTING LABORATORY: Texas Research		
	2. ANALYTICAL METHOD: Continuous phot	oionization detection	on with a 10.20 eV lamp.
	3. TEMPERATURE: 22-25°C		
	4. COLLECTION MEDIUM: N2		
	5. COLLECTION SYSTEM: N2		
	6. OTHER CONDITIONS: 1 inch cells we		
	7. DEVIATIONS FROM ASTM F739 METHOD:	Flow rate to cells	vas 100 cc/min.
3.	CHALLENGE CHEMICAL 1	: COMPONENT 2	: 3
		:	
	1. CHEM NAME(s): n-Propyl Alcohol	: N/A	:N/A
	2. CAS NUMBER(s): 71-23-8	: N/A	: N/A
	3. CONC. (IF MIX) N/A	: N/A	:N/A
	4. CHEMICAL SOURCE: Aldrich reagent	: N/A	: N/A
,	grade	: N/A	: N/A
4.	TEST RESULTS  1. DATE TESTED: July 28, 1986		
	2. NUMBER OF SAMPLES TESTED: Three	<del></del>	
	3. BREAKTHROUGH TIME: No breakthrough	was observed after	hours.
	4. MIN DETECTABLE LIMIT .76 ppm		
	5. STEADY STATE PERMEATION RATE N/A		
	6. SAMPLE THICKNESS: 18-19 mil		
	7. SELECTED DATA POINTS N/A		
	TIME : CONCENTRATION 1.	: CONCENTRATIO	N : CONCENTRATION
	2.	<del></del>	<del></del>
	3.	<del></del>	
	4.		:
	5.	:	:
	6.	:	:
	7.	:	:
	8.		<u> </u>
	9.	:	•
	10.	:	:
	8. OTHER OBSERVATIONS:		
5.	SOURCE OF DATA		
	Samples were run by Sylvia Coope	r on July 28, 1986.	

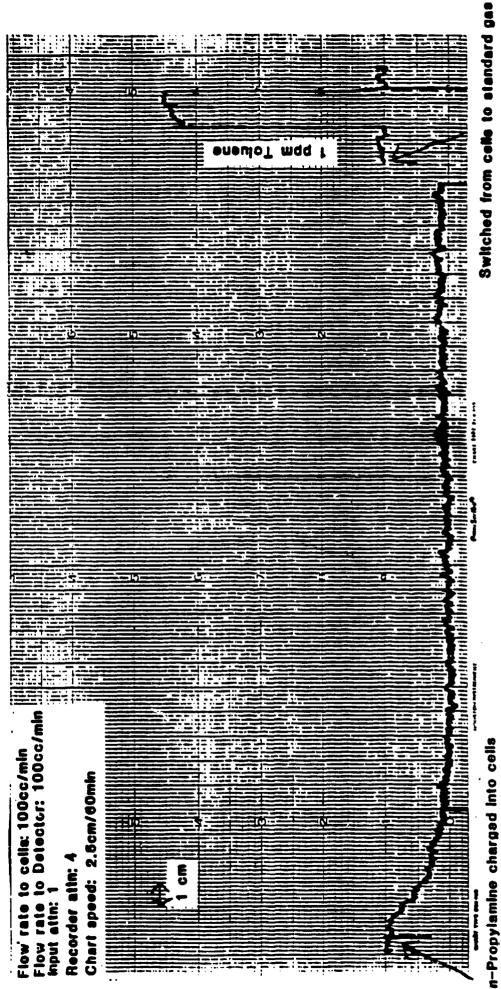
# Chemical Resistance Testing of USCG Material with n-Propyl Alcohol



n-Propyl Alcohol charged Into cells

1. DESCRIPTION OF PRODUCT EVALUATED

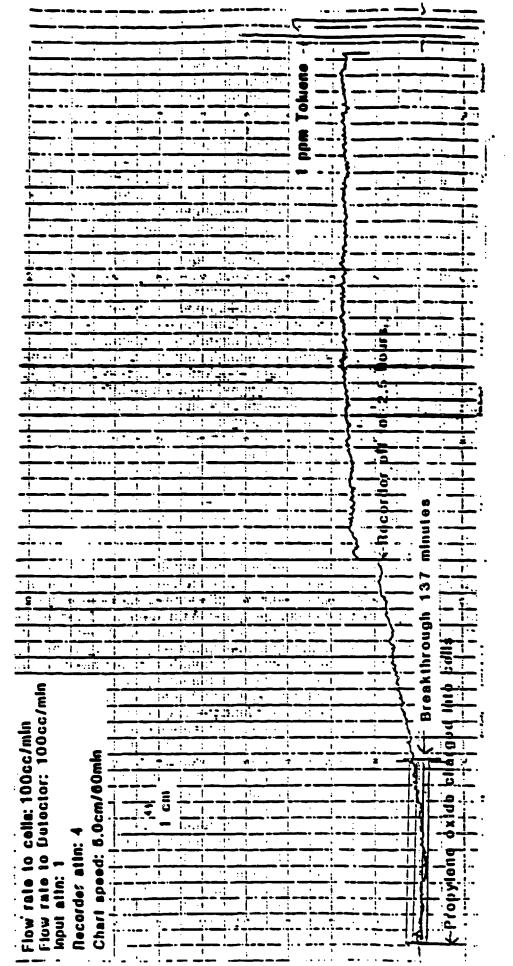
	TYPE: Teflon lam: PROTECTIVE MATER				
		TEST: Unused, no v	deible imperfection	ns	
	MANUFACTURER: C		ISTUIC IMPELIACETIC	119	
		CATION: Challenge 5	100		
	LOT OR MANUFACTU			<del></del>	/ <del></del>
-	NOMINAL THICKNESS				
8:		terial was orange co	lored on one side	and buff	colored on th
TE	EST METHOD				
1.	TESTING LABORATOR	RY: Texas Research 1	institute, 9063 Bee	Caves R	oad. Austin. T
		D: Continuous photo			
	TEMPERATURE: 22-				
4.	COLLECTION MEDIU	M: N <sub>2</sub>			
5.	COLLECTION SYSTE	M: N <sub>2</sub>			
6.	OTHER CONDITIONS	: 1 inch cells wer	e used. /Detector	Tempera	ture = 60C.
7.	DEVIATIONS FROM	ASTM F739 METHOD: F	low rate to cells	was 100	cc/min.
Сअ	IALIENCE CHEMICAL	1	: COMPONENT 2	:	3
1.	CHEM NAME (s) :		. N/A	· :	N/A
		107-10-8	: N/A	:	N/A
З.	CONC. (IF MIX)	N/A	: N/A		N/A
4.	CHEMICAL SOURCE:	Aldrich reagent	: N/A	:	N/A
TE	ST RESULTS	grade	: N/A	:	N/A
2. 3. 4.	DATE TESTED: July NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM	TESTED: Three : No breakthrough wa MT .74 ppm	s observed after l	0.2 hour	5.
	SAMPLE THICKNESS:				\
	SELECTED DATA POI				· <del></del>
	TIME :	CONCENTRATION	: CONCENTRATIO	)N : C	ONCENTRATION
	2.		:	:	
	3. :			:	
	4. :		:	:	
	5. :		:	<u>:</u>	
	6. :		:	:	
			<u> </u>		
	7. :	<del></del>		:	
	7. 8.		<u></u>	<del></del>	
	7. : 8. : 9. :				
	7. 8.				
8.	7. : 8. : 9. :	S:		:	
8.	7. : 8. : 9. : 10. :	s:			
8.	7. : 8. : 9. : 10. :	S:		•	
	7. : 8. : 9. : 10. : OTHER OBSERVATION		:		
	7. : 8. : 9. : 10. : OTHER OBSERVATION	S: un by Sylvia Cooper	:	:	



(-2-1 <del>TO TO TO THE PROPERTY OF THE </del>

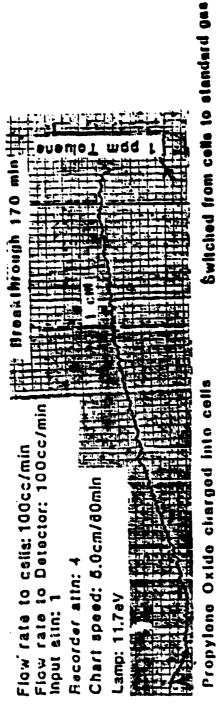
2.	TES?	T METHOD		•	
	1.	TESTING LABORA	ATORY: <u>Texas Research</u> THOD: <u>Continuous pho</u>	Institute, 9063 Bee	Caves Road, Austin
	2. 3.	TEMPERATURE:	22-25°C	colonization detection	n with a 11.7 ev i
	4.	COLLECTION MEE			
	5. 6.	OTHER CONDITION	ONS: 2 inch cells wer	e used./ Detector Tem	perature = 60C.
	7.	DEVIATIONS FRO	OM ASTM F739 METHOD:	Flow rate to cells	was 100 cc/min
3.	CHAL	LENGE CHEMICAL	. 1	: COMPONENT 2	: 3
,	1.	CHEM NAME(s) :	: Propylene Oxide	: N/A	: N/A
	2.	CAS NUMBER(s):	16088-62-3	: N/A	: N/A
	3. 4.	CONC. (IF MIX)	) N/A	N/A	. N/A
	7.	CHEMICAL SOURC	reagent grade	: N/A : N/A	N/A N/A
4.	TEST	RESULTS		` ~ <del>``</del>	
			IME: 137 min		
	5. S		LIMIT 0.68 ppm. ERMEATION RATE 1.43 SS: 18-20 mil	ug/cm² x hour.	
	5. S	STEADY STATE PE SAMPLE THICKNES	LIMIT 0.68 ppm. ERMEATION RATE 1.43 SS: 18-20 mil		: CONCENTRATION
	5. S	STEADY STATE PE SAMPLE THICKNES SELECTED DATA F	LIMIT 0.68 ppm. ERMEATION RATE 1.43 (SS: 18-20 mil		: CONCENTRATION
	5. S	STEADY STATE PE SAMPLE THICKNES SELECTED DATA F	LIMIT 0.68 ppm. ERMEATION RATE 1.43 (SS: 18-20 mil		: CONCENTRATION
	5. S	STEADY STATE PE SAMPLE THICKNES SELECTED DATA F	LIMIT 0.68 ppm. ERMEATION RATE 1.43 (SS: 18-20 mil		: CONCENTRATION
	5. S	STEADY STATE PE SAMPLE THICKNES SELECTED DATA F	LIMIT 0.68 ppm. ERMEATION RATE 1.43 (SS: 18-20 mil		: CONCENTRATION
	5. S	TIME	LIMIT 0.68 ppm. ERMEATION RATE 1.43 (SS: 18-20 mil		: CONCENTRATION
	5. S 6. S 7. S 4. S 6. S 6. S 6. S 6. S 6. S 6. S 6	TIME TIME	LIMIT 0.68 ppm. ERMEATION RATE 1.43 (SS: 18-20 mil		: CONCENTRATION
	5. S 6. S 7. S 4. S 6. S 6. S 6. S 6. S 6. S 6. S 6	TIME	LIMIT 0.68 ppm. ERMEATION RATE 1.43 (SS: 18-20 mil		: CONCENTRATION
	5. 56. 57. 5	TIME TIME	LIMIT 0.68 ppm. ERMEATION RATE 1.43 (SS: 18-20 mil POINTS N/A  : CONCENTRATION :		: CONCENTRATION
	5. 56. 57. 5	TIME TIME	LIMIT 0.68 ppm. ERMEATION RATE 1.43 (SS: 18-20 mil POINTS N/A  : CONCENTRATION :		: CONCENTRATION: :
5.	5. 56. 57. 5 7. 5 8. 0	TIME TIME	LIMIT 0.68 ppm. ERMEATION RATE 1.43 (SS: 18-20 mil POINTS N/A  : CONCENTRATION :		: CONCENTRATION:

Permeation of Propylene Oxide through USCG Material Composite Run



DESCRIPTION OF PRODUCT EVALUATED	
1: TYPE: Teflon laminated Nomex	
2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections	
4: MANUFACTURER: Chemfab Corp.	
5: PRODUCT IDENTIFICATION: Challenge 5100	
6: LOT OR MANUFACTURER DATE: N/A	
7: NOMI NAL THICKNESS: 15-20 mil	
8: DESCRIPTION: Material was orange colored on one side and buff colored on other side.	the
TEST METHOD	
1. TESTING LABORATORY: Texas Research Institute, 9063 Ree Caves Road, Austin	<u>, TX</u>
2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV T 3. TEMPERATURE: 22-25°C	amp.
4. COLLECTION MEDIUM: No	
5. COLLECTION SYSTEM: N2	
6. OTHER CONDITIONS: 2 inch cell was used./ Detector Temperature = 60C.	
7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cell was 100cc/min.	
CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3	
1. CHEM NAME(s): Propyleme Oxide : N/A : N/A	
2. CAS NUMBER(s): 75-56-9 : N/A : N/A	
3. CONC. (IF MIX) N/A : N/A : N/A	
4. CHEMICAL SOURCE: Aldrich reagent : N/A : N/A grade : N/A : N/A	
TEST RESULTS	
1. DATE TESTED: June 10, 1986 2. NUMBER OF SAMPLES TESTED: One (Run I) 3. BREAKTHROUGH TIME: 170 min. 4. MIN DETECTABLE LIMIT 1.01 ppm. 5. STEADY STATE PERMEATION RATE 1.09 ug/cm² x hour. 6. SAMPLE THICKNESS: 19 mil. 7. SELECTED DATA POINTS	
TIME : CONCENTRATION : CONCENTRATION : CONCENTRATIO	N
2	
3	
5.	
6	
7	
8	
9. : : : : : : : : : : : : : : : : : : :	
¥V•	
8. OTHER OBSERVATIONS:	
SOURCE OF DATA	
Sample was run by Sylvia Cooper on June 10, 1986.	

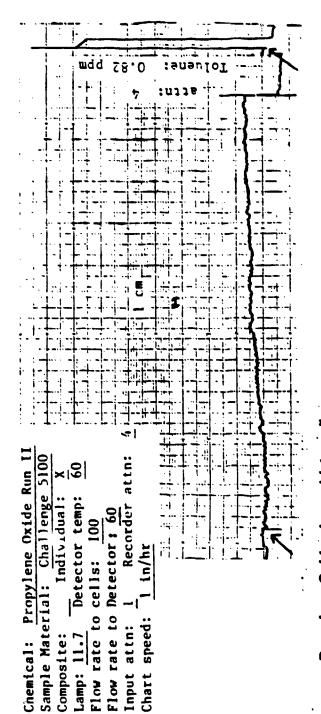
Run 1



		TYPE: Teflon laminated Nomex PROTECTIVE MATERIAL CODE: 068		
		CONDITION BEFORE TEST: Unused, no vi	isible imperfections	
	4:	MANUFACTURER: Chemfab Corp.		
		PRODUCT IDENTIFICATION: Challenge 5	100	
		LOT OR MANUFACTURER DATE: N/A		
		NOMINAL THICKNESS: 19-20 mil		
	8:	DESCRIPTION: Material was orange co- other side.	lored on one side an	d buff colored on the
2.	TES	T METHOD		
	1.	TESTING LABORATORY: Texas Research I	nstitute, 9063 Bee C	aves Road, Austin, TX
		ANALYTICAL METHOD: Continuous photo:	ionization detection	with a 11.70 eV lamp.
		TEMPERATURE: 22-25°C		
		COLLECTION MEDIUM: N2		······································
		COLLECTION SYSTEM: N2		
	٥.	OTHER CONDITIONS: 1 inch cell was	used. /Detector Te pe	rature = 60C.
•	/ •	DEVIATIONS FROM ASTM F739 METHOD: F.	ICW FATE TO CELL WAS	TOU cc/min.
L	CHA	LIENCE CHEMICAL 1	COMPONENT 2	: 3 :
	1.	CHEM NAME(s): Propylene Oxide	: N/A	: N/A
		CAS NUMBER(s): 75-56-9	N/A	: N/A
		CONC. (IF MIX) N/A	N/A	: N/A
	4.	CHEMICAL SOURCE: Aldrich	N/A	: N/A
	2. 3 3. 4. 1 5.	DATE TESTED: 1-30-87  NUMBER OF SAMPLES TESTED: One (Run II BREAKTHROUGH TIME: 195 minutes  MIN DETECTABLE LIMIT .13 ppm  STEADY STATE PERMEATION RATE 1.10 (u		
		SAMPLE THICKNESS: 19-20 mil		
	/.	SELECTED DATA POINTS N/A		
		TIME : CONCENTRATION	: CONCENTRATION	: CONCENTRATION
		1.	:	:
		2.	:	:
		3.	:	:
		4.	:	:
		5:	:	
		6	:	:
		7	<u>:</u>	:
		8	<del></del>	<u>:</u>
		9. :	<del>-                                    </del>	<u> </u>
	,	· · · · · · · · · · · · · · · · · · ·	•	•
	8.	OTHER OBSERVATIONS:		
•	sou	RCE OF DATA Sample was run by Denise McDonald	on January 30, 1987	<u> </u>
•	sou		on January 30, 1987	

### Chemical Resistance Testing of Challenge 5100

### Propylene Oxide Run II



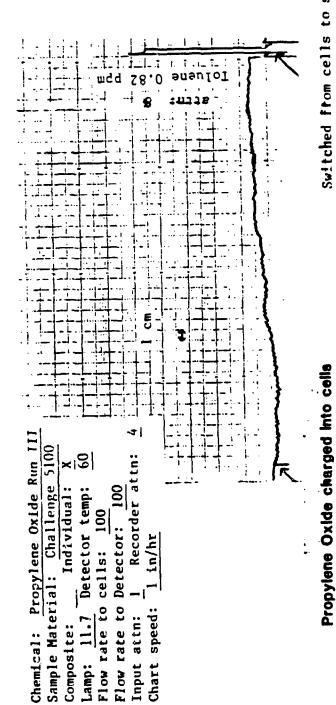
Propylene Oxide charged Into cells

Switched from cells to standard gas

DE	SCRIPTION OF PRODUCT EVALUATED		٠				
1:	TYPE: Teflon laminated Nomex						
3:	المراجع والمراجع						
3:		o visible imperfection	ns				
4:							
5:							
6:							
7:	NOMINAL THICKNESS: 19-20 mil						
8:	DESCRIPTION: Material was orange	colored on one side	and buf	f colored on the			
	other side.						
TE	ST METHOD						
1.	TESTING LABORATORY: Texas Researc	h Institute, 9063 Be	Caves	Road, Austin, T			
2.	ANALYTICAL METHOD: Continuous ph	otoionization detect:	lon with	a 11.70 eV lam			
3.	TEMPERATURE: 22-25°C						
	COLLECTION MEDIUM: N2						
	COLLECTION SYSTEM: N2						
6.	OTHER CONDITIONS: 1 inch cell w						
7.	DEVIATIONS FROM ASIM F739 METHOD:	Flow rate to cell a	res 100	ec/min_			
: CH	ALIENGE CHEMICAL 1	: COMPONENT 2	•	3			
i.	CHEM NAME(s): Propylene Oxide	: N/A	:	n/a			
	CAS NUMBER(s): 75-56-9	: N/A		N/A			
	CONC. (IF MIX) N/A	: N/A	;	N/A			
4.		: N/A	:_	N/A			
1. 2.	DATE TESTED: 2-09-87  NUMBER OF SAMPLES TESTED: One (Ru BREAKTHROUGH TIME: 169 minutes	n III)					
	MIN DETECTABLE LIMIT .13 ppm						
		(ug/or/thr)					
	STEADY STATE PERMEATION RATE .67 (ug/cm2*hr)  SAMPLE THICKNESS: 19-20 mil						
	SELECTED DATA POINTS N/A						
	TIME : CONCENTRATI	ON : CONCENTRATIO	ON :	CONCENTRATION			
	2. :		<del></del>				
	3.	•	<del></del>	·			
	4.	•	<del></del>	<del> </del>			
	5.		<del></del>				
	6.	<del></del>	<del></del> :	<del></del>			
	7.	<del></del>	<del></del>				
	8.	<del></del>	<u>-</u>	<del> </del>			
	9.	•					
	10.						
8.	OTHER OBSERVATIONS:						
-							
	INCE OF DATA						
30	URCE OF DATA	ald on Pohances 0 1	027				
<b>5</b> 0	URCE OF DATA  Sample was run by Denise McDon	ald on February 9, 1	987.				

## Chemical Resistance Testingof Challenge 5100

### Propylene Oxide Run III



Switched from cells to standard gas

1.	DES	CRIPTION OF PROD	DUCT EVALUATED		
	1:	TYPE: Teflon la	aminated Nomex		
	2:	PROTECTIVE MATE	RIAL CODE: 068		
	3:			visible imperfections	
	4: 5:	MANUFACTURER:	Chemtad Corp.  ICATION: Challenge	5100	
		LOT OR MANUFACT			<del></del>
	7:	NOMINAL THICKNE	SS: 15-20 mil		
	8:	DESCRIPTION: No other side.	<u>laterial was orange (</u>	colored on one side and	buff colored on the
		other side.			<del></del>
2.	TES	T METHOD			
	1.	TESTING LABORAT	MDV. Tavas Daraansh	Institute, 9063 Bee Cav	was Doad Austin TY
	2.	ANALYTICAL METH	10D: Ion Chromatogra	aphy on Dionex 2000.	es Road, Austin, IA
	3.	TEMPERATURE: Ar	mbient		
	4.	COLLECTION MEDICOLLECTION SYST	UM: Aqueous		
	6.	OTHER CONDITION	VS: 2 inch cells wer	re used.	
	7.	DEVIATIONS FROM	ASTM F739 METHOD:		
. <b>'3</b>	CHA	LLENGE CHEMICAL	ì	: COMPONENT 2	3
				:	
	1.	CHEM NAME (s):	Silicon Tetrachlo- ride	: N/A : N/A	N/A N/A
	2.	CAS NUMBER(s):	10026-04-07	N/A	N/A
	3.	CONC. (IF MLX)	99%	N/A	N/A
	4.		:Aldrich	: N/A	N/A
4.	TES.	T RESULTS			
	. — .				
		DATE TESTED: O	ctober 1, 1986 S TESTED: Three		
				was observed after 3 ho	ours.
	4.	MIN DETECTABLE L	IMIT_0.5 ppm		
			RMEATION RATE N/A		
		SAMPLE THICKNESS Selected Data Po		d 3 at end of three hou	r test
	•	JEELOIED PRINT	JIM 00113 1,1, 011	d o de end of enfee nou	6630
		TIME	: CONCENTRATION		: CONCENTRATION
		1. <u>3 hours</u> 2.	: <0.2 ppm	: <b>40.2</b> ppm	<0.2 ppm
		3.	:	:	
		4.	:	:	
		5.	:		
		6. 7.	•		
		B	•	•	
		9.		· · · · · ·	
	•	10	:		
	8. (	OTHER OBSERVATIO	ONS: Retention time	for 5 ppm Silicon Tetr	achloride calibration
			as 2.05 ppm.		
5.	SOLE	RCE OF DATA			
-•	230	Samples wer	re run by Denise McD	onald on October 1, 198	6 <b>.</b>

### 3Hbration-5 ppm Silicon Tetrachloride Standard

ilibration—5	ppm Silicon	Tetrachlorio	ie Standa	rd
HANNEL A	INJECT	<b>81:07:</b> 3	<b>.</b>	
$\Rightarrow$			•	
			2. 05	
FERNEATION	•		01:07:34	
FILE 1.	METHOD 5.	#UN 84	INDEX	1 CALI
AMALYST: DJM				
:•AME	PPM	RT	AREA 3C	RF
1	e. e.	1.25 12	4620 02	
CL.	<b>5.</b>	1. 52 46. 2. 85 1522	0167 03 3345 01204	5739.
TOTALS	.5.	1581	3742	
MDL-0.5 ppn	n Silicon Tetra	achioride St	andard	·
CHAMMEL A	INJECT	91:11	:24	
• =				
<del></del>	7: 92			
· PERMEATION			91:17:2	4
FILE 1.	1877-00 S.	RUN 85	INDEX	1
ANALYST: D.	JM •			
MAME	PoM	RT	AREA BC	RF
CL	9. 9. 515		176307 01 5639 <b>5</b> 2 013	34 <b>5</b> 739.
TOTALS	ə. <b>5</b> 15	1	745859	
		•		
Reagent Water	r Blank			
CHANNEL A	INJECT	91:16	• • •	
	795	21.70	• - 4	
	2.84			
PERMEATION			01:15:1	
FILE 1.	METHOD 5.	RUN 86	_	
AMALYST: D.			#174EA	•
N.C.				
HEME	bei.	RT	AREA SC	RF
<b>.</b>	9.	9. 05	97337 04	

a. 508

2641631

TOTALS

### Silicon Tetrachloride Cell 1 3 hours

CHANNEL A	INJECT .07	01:	20:31	
PERMEATION FILE 1. AMELYST: DUM	751 2.05 METHOD 5.	RUN 3		DEK 1 50:31
NAME	Moe	at.	AREA	9C /
c.	). ). ). 429	0. 37 1. 31 2. 35		01 02 03304573
737413	9, 423		2113013	

### Silicon Tetrachloride Cell 2 3 kg

22

INJEST

CHANNEL A INJECT

	2.05				
PERMEATION			91:3	3:4	•
FILE 1.	METHOD 5.	RUN 3	9 INI	E:K	1
AMALYST: D	JH				
HAME	PFM	RT	are.a	<b>9</b> C	ř
1 CL	9. 454 8. 8.	9. 96 1. 9 2. 95	5556 <i>3</i> 1436284 1412821	92	a4578
TOTALS	0. 454		2953735		

### Silicon Tetrachloride Cell 3 3 hours

01:30:15

	. 37	•			
PERMEATION			91:	:9:T	5
FILE 1.	METHOD 5.	RUN 9	<b>9</b> [N]	XZC	1
ANALYST: D	ń				
NAME	FPM	RT	AREA	3C	2
: 2	<b>3.</b>	9. 97	67661		
CT <sub>3</sub>	). ). ). ), 432	0.56 1.9 2.95	111259 1515758 1439135	92	9457S
TOTALS	9. 492	4. 77	1591302	V	.g+0. 0

(-221

1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex
	2: PROTECTIVE MATERIAL CODE: 068
	3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp.
	5: PRODUCT IDENTIFICATION: Challenge 5100
	6: LOT OR MANUFACTURER DATE: N/A
	7: NOMINAL THICKNESS: 15-20 mil
	8: DESCRIPTION: Material was orange colored on one side and buff colored on the other side.
2.	TEST METHQD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX
	2. ANALYTICAL METHOD: Atomic Absorption Spectrophotometry
	3. TEMPERATURE: Ambient
	4. COLLECTION MEDIUM: Aqueous
	5. COLLECTION SYSTEM: Aqueous
	6. OTHER CONDITIONS: 1 inch cells were used. 7. DEVIATIONS FROM ASTM F739 METHOD:
	74 BETTHIONS INON HOTH 1703 FETHOD:
.3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. CHEM NAME(s): Sodium Hydroxide : N/A : N/A
	2. CAS NUMBER(s): 1310-73-2 : N/A : N/A
	3. CONC. (IF MIX) 50% : N/A : N/A
	4. CHEMICAL SOURCE: Fisher : N/A : N/A
4.	TEST RESULTS
	1. DATE TESTED: October 13, 1986
	2. NUMBER OF SAMPLES TESTED: Three
	3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT 0.5 ppm
	5. STEADY STATE PERMEATION RATE N/A
	6. SAMPLE THICKNESS: 19-20 mil
	7. SELECTED DATA POINTS Cells 1,2, and 3 at end of three hour test.
-	TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION
	1. 3 hours : <0.5 ppm : <0.5 ppm
	2
	<b>4.</b> ————————————————————————————————————
	5. ————————————————————————————————————
	6. :
	7
	8
	9. : : : : : : : : : : : : : : : : : : :
	10
	8. OTHER OBSERVATIONS: Samples and blanks were analyzed with 0.5, 1.0, and 4.0 ppm sodium standards.
5.	SOURCE OF DATA
	Samples were run by Denise McDonald on 10-13-86.

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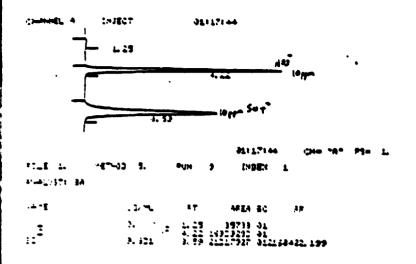
1.	DESCRIPTION OF PRODUCT EVALUATED	•	
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no v 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange coother side.		the
2.	TEST METHOD		
	1. TESTING LABORATORY: Texas Research I 2. ANALYTICAL METHOD: Atomic Absorptic 3. TEMPERATURE: Ambient 4. COLLECTION MEDIUM: Aqueous 5. COLLECTION SYSTEM: Aqueous 6. OTHER CUNDITIONS: 1 inch cells wer 7. DEVIATIONS FROM ASTM F739 METHOD:		TX
	CHALLENGE CHEMICAL 1	: COMPONENT 2 : 3	
	1. CHEM NAME(s): Sodium Hydrosulfide 2. CAS NUMBER(s): 16721-80-5 3. CONC. (IF MIX) 10% 4. CHEMICAL SOURCE: Fisher	N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	
4.	TEST RESULTS		
	1. DATE TESTED: October 14, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT 0.5 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS Cells 1,2 and 3	3 at end of three hour test.	
	TIME : CONCENTRATION  1. 3 hours : <0.5 ppm	: CONCENTRATION : CONCENTRATION : <0.5 ppm : <0.5 ppm	
	2. : : : : : : : : : : : : : : : : : : :		
	8. <u>:</u> :		
	10		
	8. OTHER OBSERVATIONS: Samples and blan Sodium standards.	anks were analyzed with 0.5, 1.0 and 4.	0 ppm
5.	SOURCE OF DATA Samples were run by Denise McDona	ald on October 14, 1986.	

, DES	CRIPTION OF PRODUC	I EVALUATED		
1:	TYPE: Teflon lami			
2: 3:	PROTECTIVE MATER	TEST: Unused, no vi	cible imperfections	
3: 4:	MANUFACTURER: CI		Sible imperfections	·
5:	PRODUCT IDENTIFIC	ATION: Challenge 51	00	
7: 8:	NOMINAL THICKNESS	erial was buff color	• <u>•</u>	
0.	DESCRIPTION:	erial was ball color		
. TES	T METHOD_			
1.		Y: Texas Research Ir	istitute, 9063 Bee Ca	ves Road, Austin, TX
2. 3.	ANALYTICAL METHOL TEMPERATURE: 22-2		onization detection	with a 11./ eV lamp.
	COLLECTION MEDIUM			
5.	COLLECTION SYSTEM	1: N <sub>2</sub>		
6.	OTHER CONDITIONS	2 inch cells were	used./ Detector Temp	erature = 60C.
		· <del></del>	BW Tate to cells was	
. CHA	LLENGE CHEMICAL	1 :	COMPONENT 2	: 3 :
		Styrene :	N/A	:N/A
		100-42-5	N/A	N/A
3. 4.	CONC. (IF MIX)	99% Ndrich Co.inhibited:	N/A	N/A N/A
٠,	CHEMICAL SOURCE:	vith 10-15ppm 4-TBC :	N/A N/A	N/A N/A
. TES	T RESULTS			·
1.	DATE TESTED: Apr	il 13, 1986		
2.	NUMBER OF SAMPLES	TESTED: Three		
	BREAKTHROUGH TIME:		was observed after 4	hours
	STEADY STATE PERMI			
	SAMPLE THICKNESS:			
7.	SELECTED DATA POI	ITS N/A		
	TIME :	CONCENTRATION	: CONCENTRATION	: CONCENTRATION
	2.		•	
	3			
	4. :			•
	6.			
	7			•
	8	·		:
	9. :		<del></del>	•
8.	OTHER OBSERVATIONS	S:		
	<del></del>	·		
. sou	RCE OF DATA			
	Samples were	run by Karen Versch	oor on April 3, 1986	

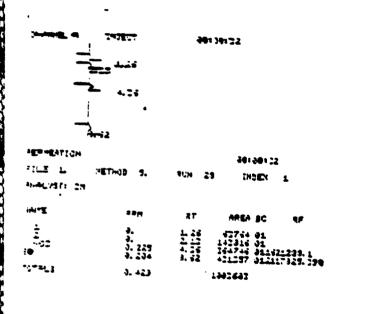
Slyrene charged into celle

witched from cells to standard gas

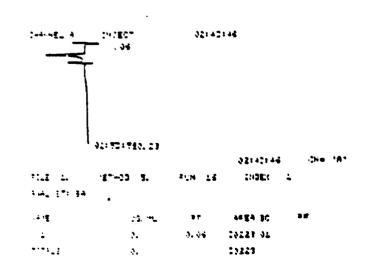
		-			AL UATED			
	1:		Teflon 1					
	2:		CTIVE MAT			vicibi	e imperfections	
	3: 4:		ACTURER:			A 12 1 D I	e imperiections	
	5:	PRODU	CT IDENTI	FICATIO	N: Challenge	5100	مردانده عبيرانا المضروبا المستورية والاستد	
	6:	LOT O	r manufac	TURER D	ATE: N/A			
	7:		AL THICKN		5-20 mil			
	8:	DESCR	IPTION: _ r side	Materia	was orange c	olored	on one side and	buff colored on t
						<del>~</del>		<del></del>
2.	TES	T METH	กก์					
	1.	TESTI	NG LABORA	TORY: T	exas Research	Instit	ute, 9063 Bee Ca	eves Road, Austin,
	2.	TEMPE	RATURE:	Ambient	on Chromatogra	ny on	Dionex 2000.	
	4.		CTION MED		queous			
	5.		CTION SYS		queous			
	6.	OTHER	CONDITIO	NS: 2	inch cells wer	e used		
	7.	DEAIY	TIONS FRO	M ASTH	F739 METHOD:			
3.	CHA	LLENGE	CHEMICAL		1	: 6	OMPONENT 2	: 3
	1.	CHEM	NAME(s):	Sulfu	ric Acid	:	N/A	: N/A
		CAS N	LIMBER(s):	7664-	93-9	:==	N/A	: N/A
	3.	CONC.	(IF MIX)	95%		_:	N/A	:N/A
	4.	CHEMI	CAL SOURC	E: Mai ! 1	nckroot	-:	N/A	N/A
4.	TES	T RESU	LTS	<del></del>	<del></del>	··	· ···	
	•	DATE T	ECTED. C	+-mb-	- 12 1006			
			OF SAMPL		r 12, 1986. ED: Three			
			HROUGH TI			observ	ed after 3 hours	S.
	•			I TMT T A	.2 ppm			
	4.	MIN DE	TECTABLE	E IMI I				
	5.	STEADY	STATE PE	RMEAT TO	N RATE N/A			
	5. 6.	STEADY SAMPLE	STATE PE THICKNES	RMEAT 10 S: 19-	N RATE <u>N/A</u> 20 mil	3 at	end of three ho	er test
	5. 6.	STEADY SAMPLE	STATE PE THICKNES	RMEAT 10 S: 19-	N RATE <u>N/A</u> 20 mil Cells 1,2, and		end of three ho	
-	5. 6.	STEADY SAMPLE SELECT	STATE PE THICKNES ED DATA P	RMEAT 10 S: 19-	N RATE N/A 20 mil Cells 1,2, and CONCENTRATION		CONCENTRATION	: CONCENTRATION
-	5. 6. :	STEADY SAMPLE SELECT	STATE PE THICKNES ED DATA P	RMEAT 10 S: 19-	N RATE <u>N/A</u> 20 mil Cells 1,2, and			
-	5. 6. : 7.	STEADY SAMPLE SELECT	STATE PE THICKNES ED DATA P	RMEAT 10 S: 19-	N RATE N/A 20 mil Cells 1,2, and CONCENTRATION		CONCENTRATION	: CONCENTRATION
-	5. 6. : 7.	STEADY SAMPLE SELECT	STATE PE THICKNES ED DATA P	RMEAT 10 S: 19-	N RATE N/A 20 mil Cells 1,2, and CONCENTRATION		CONCENTRATION	: CONCENTRATION
-	5. 6 7.	STEADY SAMPLE SELECT	STATE PE THICKNES ED DATA P	RMEAT 10 S: 19-	N RATE N/A 20 mil Cells 1,2, and CONCENTRATION		CONCENTRATION	: CONCENTRATION
-	5. 6. :	STEADY SAMPLE SELECT	STATE PE THICKNES ED DATA P	RMEAT 10 S: 19-	N RATE N/A 20 mil Cells 1,2, and CONCENTRATION		CONCENTRATION	: CONCENTRATION
-	5. 6. : 7.	STEADY SAMPLE SELECT	STATE PE THICKNES ED DATA P	RMEAT 10 S: 19-	N RATE N/A 20 mil Cells 1,2, and CONCENTRATION		CONCENTRATION	: CONCENTRATION
-	5. 6. : 7.	STEADY SAMPLE SELECT	STATE PE THICKNES ED DATA P	RMEAT 10 S: 19-	N RATE N/A 20 mil Cells 1,2, and CONCENTRATION		CONCENTRATION	: CONCENTRATION
-	5. 6. : 7.	STEADY SAMPLE SELECT	STATE PE THICKNES ED DATA P	RMEAT 10 S: 19-	N RATE N/A 20 mil Cells 1,2, and CONCENTRATION		CONCENTRATION	: CONCENTRATION
-	5. 6. 7.	STEADY SAMPLE SELECT	STATE PE THICKNES ED DATA P TIME 3 hours	RMEATIO S: 19-	N RATE N/A 20 mil Cells 1,2, and CONCENTRATION <0.2 ppm		CONCENTRATION <0.2 ppm	CONCENTRATION CO.2 ppm
-	5. 6. 7.	STEADY SAMPLE SELECT  1 2 3 4 5 6 7 8 9 OTHER	STATE PE THICKNES ED DATA P TIME 3 hours	RMEATIO S: 19- OINTS	N RATE N/A 20 mil Cells 1,2, and CONCENTRATION <0.2 ppm		CONCENTRATION <0.2 ppm	: CONCENTRATION
-	5. 6	STEADY SAMPLE SELECT  1 2 3 4 5 6 7 9 0THER 8	STATE PE THICKNES ED DATA P TIME 3 hours  OBSERVATI 59 minute	RMEATIO S: 19- OINTS	N RATE N/A 20 mil Cells 1,2, and CONCENTRATION <0.2 ppm		CONCENTRATION <0.2 ppm	CONCENTRATION CO.2 ppm
5.	5. 6	STEADY SAMPLE SELECT  1 2 3 4 5 9 OTHER 8.	STATE PE THICKNES ED DATA P TIME 3 hours  OBSERVATI 59 minute	RMEATIOS: 19-	N RATE N/A 20 mil Cells 1,2, and CONCENTRATION <0.2 ppm  etention time	for 10	CONCENTRATION <0.2 ppm  ppm Sulfate ca	CONCENTRATION CO.2 ppm  iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
5.	5. 6	STEADY SAMPLE SELECT  1 2 3 4 5 9 OTHER 8.	STATE PE THICKNES ED DATA P TIME 3 hours  OBSERVATI 59 minute	RMEATIOS: 19-	N RATE N/A 20 mil Cells 1,2, and CONCENTRATION <0.2 ppm  etention time	for 10	CONCENTRATION <0.2 ppm	CONCENTRATION CO.2 ppm
5.	5. 6	STEADY SAMPLE SELECT  1 2 3 4 5 9 OTHER 8.	STATE PE THICKNES ED DATA P TIME 3 hours  OBSERVATI 59 minute	RMEATIOS: 19-	N RATE N/A 20 mil Cells 1,2, and CONCENTRATION <0.2 ppm  etention time	for 10	CONCENTRATION <0.2 ppm  ppm Sulfate ca	CONCENTRATION CO.2 ppm

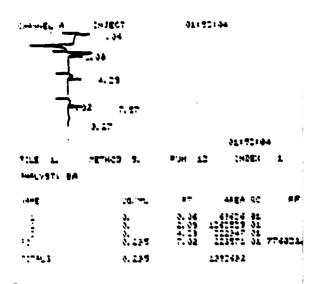


### MDL-0.5 ppm Sulfate Standard

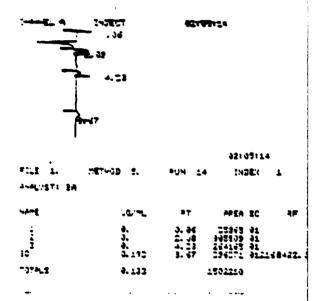


### Reagent Water Blank

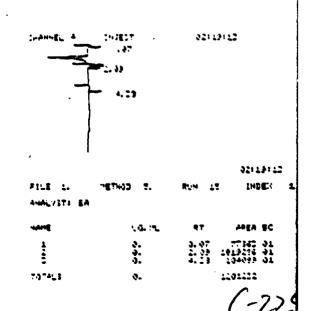




### Sulfuric Acid Cell 2 3 hours



### Sulfuric Acid Cell 3 3 hours



1.	DESCRIPTION OF PRODUCT EVALUATED	ے کے بات
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068	· ·
	3: CONDITION BEFORE TEST: Unused, no visit	le imperfections
	4: MANUFACTURER: Chemtap Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100	
	5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A	·
	7: NOMINAL THICKNESS: 15-20 mil	
	8: DESCRIPTION: Material was orange colore	d on one side and buff colored on the
	other side.	
2.	TEST METHOD-	
	1. TESTING LABORATORY: Texas Research Insti 2. ANALYTICAL METHOD: Ion Chromatography o	tute, 9063 Bee Caves Road, Austin, TX
	3. TEMPERATURE: Ambient	III D TONCK BOOD!
	4. COLLECTION MEDIUM: Aqueous	
	5. COLLECTION SYSTEM: Aqueous	
	6. OTHER CONDITIONS: 2 inch cells were use 7. DEVIATIONS FROM ASTM F739 METHOD:	عول المن المن المن المن المن المن المن الم
	7. DEVIATIONS FROM ASIM F739 METHOD:	in the second se
3.	CHALLENGE CHEMICAL 1 : .	COMPONENTEZ : 3
	:	:
	1. CHEM NAME(s): Sulfur Monochloride:	N/A : N/A
	2. CAS NUMBER(s): 10025-67-9 3. CONC. (IF MIX) 97%	N/A
	4. CHEMICAL SOURCE: Aldrich	N/A N/A
4.	TEST RESULTS  1. DATE TESTED: October 6, 1986  2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: N/A  4. MIN DETECTABLE LIMIT 0.5 ppm.  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 19-20 mils	
	7. SELECTED DATA POINTS Cells 1,2, and 3 at	the end of 3 hour test.
	TIME : CONCENTRATION : 1. 3 hours : <0.5 ppm : 2.	CONCENTRATION : CONCENTRATION CO.5 ppm : <0.5 ppm
	3.	
	4	<del></del>
	5.	:
	6	
	7. <u>:</u> : :	
	9.	
	10	
	8. OTHER OBSERVATIONS: Retention time for 2.07 minutes.	5 ppm Sulfur Monochloride standard was
<b>5.</b>	SOURCE OF DATA Samples were run by Denise McDonald	on October 6, 1986.

;alibration-	5 ppm Sulfur Mon	ochloride Standard				
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:=*;;,		19:17:17 (MM 74)	Pin A.	•		
	3D 5 \$.4 27	INIEN 1 CALIB	• •	nochioride	Cell 1 3 hour	, P <b>o</b>
			Oonal M			•
	22m 2*	** <b>E</b> \$ <b>E</b> \$	SPANEL A	INDECT		
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			<b>A</b>			
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	-		4H=14821 234			
· ·			m## <b>\$</b>	##M	PT AES	14 40
MDI =0.5 nor	n Sulfur Monochio	ride Standard	4	e.	0.07 10658	:5 <b>e</b> 1
· · · · · · · · · · · · · · · · · · ·		inge Creticet a	CL.	8.49b	1.8 167815 2.84 171158	9 67
			1074_\$	e.	::17:2	<b>;</b> 4
		149173		<b></b> .	• • •	
<b></b>	دن شه دنش		Sulfer Mo	nochloride (	Cell 2 3 hours	B
**************************************		13:46:13				
THEATION .E 1. ME	THOS S. RUN '		CHANNEL A	INJECT	15:55:53	
		<b>2</b> (1761 <b>2</b>		. 67		
•				. 84		
4度差	rPM RT	AREA BC FF	PERMEATION		15	175:
•	). 1. 24 3 1. 25		FILE 3.	rethod 5.	RUN 31	•
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<b>V</b>	<b>4</b>		HENE	beid	FT ARE	A 5:
			Cr <sub>2</sub>	e. 3.231	0.07 £1456 2.00 71201	
			TETALS	ė.		
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Reagent Water	r Blank		Sulfur Mo	nochloride (	Cell 3 3 hours	S
C-4-4 <u>()</u> =	INJEIT	. 13:51:43			•	
	. 27		( • • · · · · · · · · · · · · · · · · ·	INCELT	10:13:13	
	<del>***</del>					;
FEFTETTION		13:51:43	•	: 24		
FILE 1.	METHOD 5. RI	N 10 INDEK 1	FERRENTIN File (1.	u		3:13:
AMALYST: DI		<b>-</b>	**************************************	427m:1 4.	F.% 18 :	1415
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cu <sup>1</sup>			·4** <b>±</b>	= E ·4		EA E
		% 07 201255 01 % 06 467173 012030752.	•	3. 3. (4)	0.07 1755 2.04 7854	3 8
707-63	6. 727	670474	-::	٠.	7:33	1

		UCT EVALUATED		
		minated Nomex		
		RIAL CODE: 068		البائد الموالية المعاولات والمستحد الموادد
			visible imperfections	
4: MANUF	ACTURER:	Chemfab Corp.		
		ICATION: Challenge	2100	
		URER DATE: N/A		
		SS: 15-20 mil	alanad an ana aida and	
	er side.	aterial was orange c	olored on one side and	buff colored on th
TEST METH				
	_			
1. TESTI	NG LABORAT	ORY: <u>Texas Research</u>	<u>Institute, 9063 Bee Cav</u>	<u>res Road, Austin, T</u>
2. ANALY	TICAL METH	OD: <u>Continuous phot</u>	oionization detection v	with a 11.70 eV lan
3. TEMPE	RATURE: 22	-25°C		<u> </u>
	CTION MEDI			
J. CULLE	CTION SYST	EM: N2		
7 DEVIA	TIONS EDOM	ACTH E730 METURD:	re used. /Detector Temp Flow rate to cells was	perature = buc.
	TITONS FROM	ASIM F739 METHOU:	FIOW Pate to ceils was	
CHALLENGE	CHEMICAL	1	: COMPONENT 2	<b>3</b>
1. CHEM	NAME(s):	1,1,2,2,-Tetra-	: K/A	N/A
2 CRC N	HIMDED/al.	chloroethane	: N/A	N/A
	LIMBER(s):		: N/A ::	N/A
		N/A	: N/A	N/A
4. CHEMI	CAL SOURCE	:Aldrich reagent grade	: N/A : N/A	N/A N/A
TEST RESU	LTS	grade		177
1. DATE T	ESTED: Ma	v 19,1986		
		S TESTED: Three		
3. BREAKT	HROUGH TIM	E: No breakthrough	was observed after 15.2	hours
4. MIN DE	TECTABLE L	IMIT C.23 ppm		
		MEATION RATE N/A		ب المداوي المداوي المداور الأمام والأمام
6. SAMPLE	THICKNESS	: 17-19 mil.		
7. SELECT	ED DATA PO	INTS N/A		
	TIME	: CONCENTRATION	: CONCENTRATION :	CONCENTRATION
1: —		<u>:</u>		
3		:		
4. — 5. —		:		
6. —		•		· · · · · · · · · · · · · · · · · · ·
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O. UINEK	POSEKIVITO	·		<del></del>
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SOURCE OF		mum hu Culuda Cassa	May 10 1006	
79	mpres were	run by Sylvia Conpe	r un may 19, 1900	

## Chemical Resistance Testing of USCG Material with

### 1,1,2,2-Tetrachloroethane

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I STELLER STELLEN DER KANNEN DER KANNEN BERTEILE BERTEILE FREI FER FREI FREI
cm/60mfn cm/
to Cella: 100cc/min  1 ath: 4  ath: 4
Flow rate to celle: 100cc/min hput aitn: 1 Recorder attn: 4 Chart apeed: 5.0cm/60min  Chart apeed: 5.0cm/60min  1 cm 1 cm 1 cm 1 cm 1 cm 1 cm 1 cm 1 c
Page Range R
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	•	RODUCT EVALUATED						
1:		laminated Nomex						
2:								
3:		FORE TEST: Unused, no vis:	lble imperiections					
4:		Chemfab Corp.						
5:		rification: Challenge 5100	) 					
		ACTURER DATE: N/A						
		ONESS: 15-20 mil						
8:	other side.	Material was orange colo	red on one side an	nd buil colored on th				
TE	ST METHOD							
1.	TESTING LABOR	RATORY: Texas Research Ins	titute, 9063 Bee C	aves Road, Austin, T				
2.		ETHOD: Continuous photoio	nization detection	with a 11.70 eV lam				
3.								
	COLLECTION M							
	COLLECTION ST							
6.	OTHER CONDIT	IONS: 1 inch cells were	used. /Detector Te	mperature = 60C.				
7.	DEVIATIONS F	ROM ASTM F739 METHOD: Flor	w rate to cells wa	s 100 cc/min.				
CH	ALLENGE CHEMIC	AL 1 :	COMPONENT 2	: 3				
1.	CHEM NAME(s)	: Tetrachloroethylene :	N/A .	: N/A				
	CAS NUMBER(s		N/A	: N/A				
	CONC. (IF MI		N/A	: N/A				
		RCE: Aldrich reagent :	N/A	: N/A				
		grade :	N/A	: N/A				
1. 2. 3.	BREAKTHROUGH '	PLES TESTED: Three TIME: No breakthrough was	observed after 10.	4 hours				
	MIN DETECTABLE							
		PERMEATION RATE N/A						
_		ESS: 18-19 mil						
7.	SELECTED DATA	POINTS N/A						
	TIME	: CONCENTRATION	: CONCENTRATION	: CONCENTRATION				
	2.	•	:	:				
	3.	:	:	:				
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Chemical Resistance Testing of USCG Material with Tetrachloroethylene

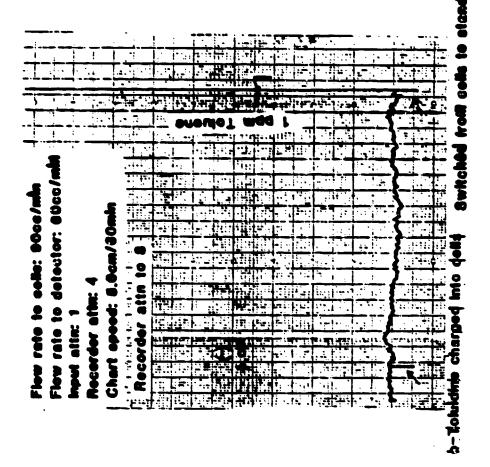
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low rate to cella: 100cc/min low rate to Detector: 100cc/min interest atm: 4 that apped: 6.0cm/60min							7.	

. DE	SCRIPTION OF PRO	DUCT EVALUATED		•
1:				· · · · · · · · · · · · · · · · · · ·
2: 3:		RE TEST: Unused, no v	isible imperiors	
4:			is rore imperfections	
5:		FICATION: Challenge 5	100	
	LOT OR MANUFAC			
7:				
8:	DESCRIPTION: _	Material was orange co	lored on one side and	buff colored on the
	other side.			
. TE	ST METHOD			
1.	TESTING LABORA	TORY: Texas Research I	nstile a. 9063 Bee Car	ves Road, Austin, TX
2.	ANALYTICAL METI	HOD: Continuous photo	ionization detection v	with a 11.7 eV lamp.
	TEMPERATURE: 2			
6.	OTHER CONDITIO	TEM: No NS: 2 inch cells were	used. / Detector Lemna	rature = 600
7.	DEVIATIONS FRO	ASTH F739 HETHOD: F	ow rate to sells was	90cc/min.
.CH	ALLENGE CHEMICAL	1	COMPONENT 2	3
1.	CHEM NAME (s):	Toluene	¶/A	N/A
2.	CAS NUMBER(s):	108-88-3	N/A	N/A
3. 4.	CONC. (IF MIX) CHEMICAL SOURCE	N/A	N/A	N/A
٠.	CHEMICIT SOURCE	E: U.I. Daker	: <u>N/A</u> :	N/A
TE	ST RESULTS	•		
	DATE TESTED: A			
		ES TESTED: Three		
3.	BREAKINKUUGH III	ME: No breakthrough w	as observed after 3 ho	ours
5	MIN DETECTABLE I	RMEATION RATE N/A		<del></del>
6.	SAMPLE THICKNESS	S: 17-19 mil		
	SELECTED DATA PO			
	TIME	: CONCENTRATION	: CONCENTRATION :	CONCENTRATION
	2.	:		
	3.			
	4	<u>:</u>		
	6.			
	7.	:		
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	10.	:		
R	OTHER ORSERVATIO	ONC ·		
٥.	— — —	ONS:		
60	UDOE OF BASA			
<b>S</b> 0	URCE OF DATA Samples wer	e run by Karen Verscho	or on April 2, 1986	

Chemical Resistance Testing of USCO Material with Toluene

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Flow rate to defet docc/min. Flow rate to defeator: 60-c/min. Chart apped: 2.5cm/10nhr. Input affic: 1			2
Flow ratelto e Flow rate to c Chart epeed: Input attn: 1 Recorder attn			
Flow Chan			

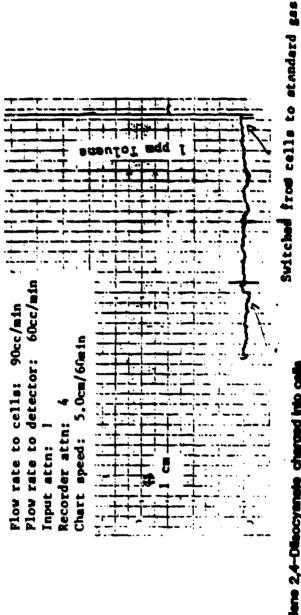
1.	DESCRIPTION OF PRODUCT EVALUATED
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was buff colored
2.	TEST METHOD
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.7 eV lamp. 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: Z inch cells were used./ Detector Temperature = 60C. 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was 90cc/min
3.	CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3
	1. CHEM NAME(s): 0-Toluidine 2. CAS NUMBER(s): 95-53-4 3. CONC. (IF MIX) N/A 4. CHEMICAL SOURCE: J.T.BAKER Practical grade  TEST RESULTS  1. DATE TESTED: April 11, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough was observed after 3.25 hours 4. MIN DETECTABLE LIMIT 0.43 ppm. 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 17-19 mil
	7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION :
	2. : : : : : : : : : : : : : : : : : : :
	6. : : : : : : : : : : : : : : : : : : :
	9
	E. OTHER OBSERVATIONS:
5.	Source OF DATA Samples were run by Karen Verschoor on April 11, 1986



100 CO

-1:		laminated Nomex				
2:		IRIAL CODE: 068				
4:	MANUFACTURER:	Chemfab Corp.			الكالي الأوران كواني واليوادية و	
5:	PRODUCT IDENTI	FICATION: Challenge 5	.00			
7:				,		
<b>8</b> :	Description:	Material was buff color	red			
TES	IT METHOD				•	
1.		CORY: Texas Research Is				
		HOD: Continuous photo:	conization detection	on with	11.70 eV lam	
-	TENTIATAL:					
	Correction was					
	COLLECTION STS					
••	OTHER CONDICTO	NS: 2 inch sells were	used /Defector To	MDeletn	e = 60C.	
7.	DEVIATIONS FRO	M ASIM F739 METEOD: Flo	ow rate to cells w	as yucc/	213	
Cit	TIENCE CHEMICAL	. 1	टान्ट्रकाटना 2	•	3	
1.	THEM NAME (8)		¥/A	:	3/4	
		diisocyanate	A/K	:	N/A	
2.	CAS NUMBER(s):	384-34-3	N/A	:	N/A	
3.	CONC. (IF MIX)		N/A		. id . i	
4.	CREMICAL SOURCE	E: Aldrich Technical	N/A		A	
		grade	N/A		N/A	
TES	EST RESULTS					
	DATE TESTED: _A					
		IS TESTED: Three				
3.	BREAKTEROUGE TI	ME: No breakthrough w	s observed efter	3.25 hou	7.8	
	HIN DETECTABLE				والمستقد المستقي والمستقد والم	
		RMEATION RATE N/A				
	SAPLE THICKNES					
7.	SELECTED DATA F	OINIS N/A				
	TIME	: CONCENTRATION	: CONCENTRATIO	N : C	ONCENTRATION	
	2.	<del>-</del>	_ <del>`</del>	<u>:</u>		
	3:		<u>:</u>	<del></del> -		
	4,	•	:	:		
	5.		:	:		
	6.			1		
	7.					
	8.	:	:	:		
	9.	3		:		
	10.	:				
	OTHER OBSERVATI	IONS:				
8.		· · · · · · · · · · · · · · · · · · ·				
8.						

RESERVED RESERVED



1. DESCRIPTION OF PRODUCT EVALUATED

	2: PROTECTIVE MATERIA	AL CODE: 068					
	3: CONDITION BEFORE	TEST: Unused, no vi	sible imperfections				
		emfab Corp. ATION: Challenge 51	30				
	6: LOT OR MANUFACTURE						
	7: NOMINAL THICKNESS	: 15-20 mil					
	8: DESCRIPTION: Mat other side.	erial was orange co	ored on one side and	buff colored on the			
	TEST METHOD						
	1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, TX 2. ANALYTICAL METHOD: Continuous photoionization detection with a 11.70 eV lamp 3. TEMPERATURE: 22-25 C 4. COLLECTION MEDIUM: N2						
	5. COLLECTION SISTEM	:_ N2					
	6. OTHER CONDITIONS: 7. DEVIATIONS FROM A	2 inch cells were	used./Detector Tempe w rate to cells was I	rature = 60C.			
	7. DETINITIONS FROM A	31M 7/39 ME 11100: F10	A LEFE TO CELLY MED T	oo ee/min.			
	CHALLENGE CHEMICAL	1 :	COMPONENT 2 :	3			
	1. CHEM NAME (s) : I	richloroethane :	N/A	N/A			
	2. CAS NUMBER(s): 7 3. CONC. (IF MIX) N	1-55-6	N/A	N/A N/A			
	4. CHENICAL SOURCE: A	drich meagent	N/A :				
		rade	<del></del>	N/A			
	TEST RESULTS	والمستهدان والمستوالين والمستوالين	. والأرسي البرادية والبرادية				
	IEST KESOFIS						
		• 6 1986 ·					
	1. DATE TESTED: Jun						
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME:	TESTED: Three No breakthrough was	observed after 3 hou	rs.			
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM	TESTED: Three No breakthrough was IT60 ppm	observed after 3 hou	rs.			
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME	TESTED: Three No breakthrough was IT .60 ppm ATION RATE N/A	observed after 3 hou	rs.			
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS:	TESTED: Three No breakthrough was IT .60 ppm ATION RATE N/A 18-20 mil	observed after 3 hou	rs.			
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN	TESTED: Three No breakthrough was IT .60 ppm ATION RATE N/A 18-20 mil TS N/A					
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS:	TESTED: Three No breakthrough was IT .60 ppm ATION RATE N/A 18-20 mil	observed after 3 hou  : CONCENTRATION : :	CONCENTRATION			
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN  TIME: 1. : 2. :	TESTED: Three No breakthrough was IT .60 ppm ATION RATE N/A 18-20 mil TS N/A					
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN  TIME: 1. ::	TESTED: Three No breakthrough was IT .60 ppm ATION RATE N/A 18-20 mil TS N/A					
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN  TIME 1	TESTED: Three No breakthrough was IT .60 ppm ATION RATE N/A 18-20 mil TS N/A					
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN  TIME: 1. : 2. :	TESTED: Three No breakthrough was IT .60 ppm ATION RATE N/A 18-20 mil TS N/A					
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN  TIME: 1. : 2. : 3. : 4. : 5. : 6. : 7. :	TESTED: Three No breakthrough was IT .60 ppm ATION RATE N/A 18-20 mil TS N/A					
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN  TIME: 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :	TESTED: Three No breakthrough was IT .60 ppm ATION RATE N/A 18-20 mil TS N/A					
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN  TIME: 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	TESTED: Three No breakthrough was IT .60 ppm ATION RATE N/A 18-20 mil TS N/A					
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN  TIME: 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :	TESTED: Three No breakthrough was IT .60 ppm ATION RATE N/A 18-20 mil TS N/A					
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN  TIME: 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	TESTED: Three No breakthrough was IT .60 ppm ATION RATE N/A 18-20 mil TS N/A  CONCENTRATION					
	1. DATE TESTED: Jun 2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIME: 4. MIN DETECTABLE LIM 5. STEADY STATE PERME 6. SAMPLE THICKNESS: 7. SELECTED DATA POIN  TIME 1	TESTED: Three No breakthrough was IT .60 ppm ATION RATE N/A 18-20 mil TS N/A  CONCENTRATION					

## Chemical Resistance Testing of USCG Material with Trichloroethane

Flow rate to cells: 100cc/min
Flow rate to Descript: 100cc/min
Recorder attn: 4
Chart appead: 5.0cm/80min
Lamp: 11.7 ev

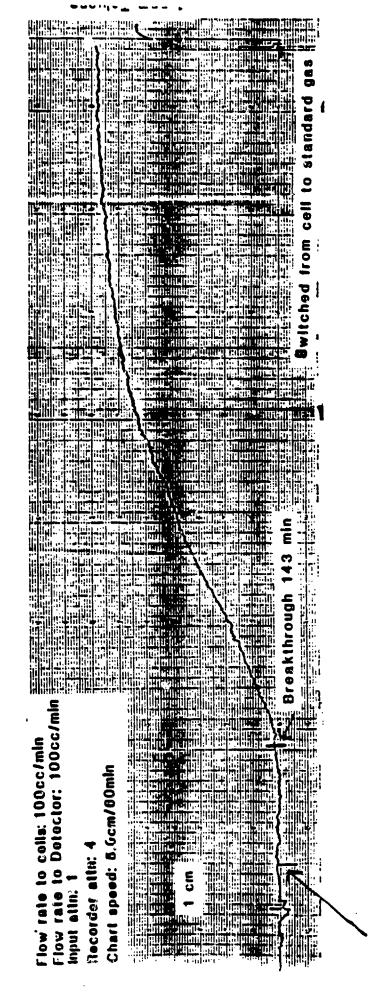
Inchloroethane charged into cells

Switched from calls to standard &se

1:	TYPE: Teflon law PROTECTIVE MATER	RIAL CODE: 068		
3:		E TEST: Unused, no vis	ible imperfections	
4:	MANUFACTURER:			
5:		ICATION: Challenge 510	00	
6:	LOT OR MANUFACT			
7:	NGMINAL THICKNES			
8:	DESCRIPTION: M	aterial was buff color	10	
TES	ST METHOD			
1.		ORY: Texas Research Ins	stitute, 9063 Bee Cave	s Road, Austin, T
	- ANALYTICAL METH	OD: Continuous photoic	onization detection wi	th a 11.70 eV lan
3.		-25°C		
4.	COLLECTION MEDI	UM: N2		
5.	COLLECTION SYST	EM: N2		
Ō.	OTHER CONDITION	S: 2 inch cell was us	sed /Detector Temperat	ure = 60C.
7.	DEATHITONS LYON	ASTM F739 NETHOD: F15	A Late to Cell Mes and	C/MIn.
CHA	LLENGE CHEMICAL	1 :	COMPONENT 2 :	3
1.	CHEM NAME (s) :	Trichloroethylene :	11/3	N/A
	CAS NUMBER(s):		N/A :	N/A
3.	CONC. (IF MIX)	N/A	N/A :	N/A
4.	CHEMICAL SOURCE	:Aldrich reagent :	N/A :	N/A
	T RESULTS	grade :	N/A	N/A
2. 3. 4. 5. 6.	BREAKTHROUGH TIM MIN DETECTABLE L	S TESTED: One (Run I) E: 143 min. IMIT 0.07 ppm MEATION RATE 2.04 ug/s : 17-19 mil	cm- hour	
	TIME 1	: CONCENTRATION	: CONCENTRATION :	CO NCENTRATION
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	5.	•	<del>::</del>	
	<b>6</b> .	:	<del>:</del>	
	7.	<u>:</u>	•	
	8.	<u> </u>		
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	•			
8.	OTHER OBSERVATIO	NS:		

# Permeation of Trichloroethylene through USCG Material

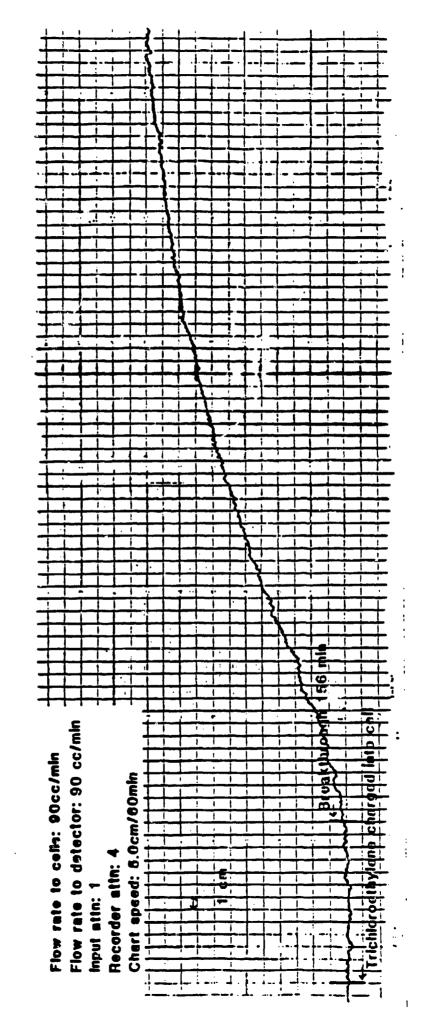
Run



Trichloroethane charged into cells

2		ERIAL CODE: 068			
		RE TEST: Unused, no v	<u> </u>	s	
	: MANUFACTURER:				
	PRODUCT IDENTI	FICATION: Challenge 5 TURER DATE: N/A	109		
		ESS: 15-20 mil			
		Material was buff cold	red.		<del></del>
Ī					······································
1	TEST METHOD				
_	. TESTING LABORA	TORY: Texas Research I	nstitute, 9063 Bee	Caves Ro	d, Austin, TX
3	. TEMPERATURE: 2		nonization detection	n with a	11./ eV lamp.
	. COLLECTION MED				
5	. COLLECTION SYS	TEM: N2			
7	5. OTHER CONDITIO 7. DEVIATIONS FRO	NS: 2 inch cell was M ASTM F739 METHOD: F	low rate to cell wa	perature s 90cc/m	= 60C.
C	CHALLENGE CHEMICAL	1	: COMPONENT 2	:	3
1	. CHEM NAME(s):	Trichloroethylene	: :	:	N/A
	. CAS NUMBER(s):		: N/A		N/A
3	. CONC. (IF MIX)	N/A	: N/A	_;	N/A
4	. CHEMICAL SOURC	E:Aldrich reagent	: N/A	_;	N/A
T	EST RESULTS	grade	: N/A	:	N/A
1	. DATE TESTED: A	pril 29, 1986 ES TESTED: One (Run II			·
	B. BREAKTHROUGH TI				· · · · · · · · · · · · · · · · · · ·
	. MIN DETECTABLE				<del></del>
5	. STEADY STATE PE	RMEATION RATE 1.63 ug	/cm² hour	<del></del>	
6	. SAMPLE THICKNESS	S: 17-19 mil			<del></del>
7	. SELECTED DATA P	OINTS			
	TIME 1.	: CONCENTRATION	: CONCENTRATION	: œı	CENTRATION
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	OTUED ODEEDWATE				
Ω					
8	3. OTHER OBSERVATION	····			

Permeation of Trichloroethylene through USCG Material Run II



DESCRIPTION OF PRODUCT EVALUATED		
1: TYPE: Teflon laminated Nomex		
2: PROTECTIVE MATERIAL CODE: 068		
3: CONDITION BEFORE TEST: Unused, no	Visible imperfections	
4: MANUFACTURER: Chemfab Corp.		
5: PRODUCT IDENTIFICATION: Challenge	5100	
6: LOT OR MANUFACTURER DATE: N/A		
7: NOMINAL THICKNESS: 15-20 mil		
8: DESCRIPTION: Material was buff col	ored.	
TEST METHOD	·	
1. TESTING LABORATORY: Texas Research	Institute, 9063 Bee Car	ves Road, Austin, TX
2. ANALYTICAL METHOD: Continuous phot 3. TEMPERATURE: 22-25°C	oionization detection i	with a 11.7 eV lamp.
		<u></u>
5. COLLECTION SYSTEM: No	·	- 700
6. OTHER CONDITIONS: 2 inch cell was	used./ Detector Temper	ature = ouc.
7. DEVIATIONS FROM ASTM F739 METHOD:	Flow rate to cell was S	90 cc/min
CHALLENGE CHEMICAL 1	: COMPONENT 2	.3
1. CHEM NAME(s): Trichloroethylene	N/A	N/A
2. CAS NUMBER(s): 79-01-6	: N/A	N/A
3. CONC. (IF MIX) N/A	: N/A	: N/A
4. CHEMICAL SOURCE: Aldrich reagent	: N/A	N/A
grade	: "N/A	N/A
TEST RESULTS		
1. DATE TESTED: April 30, 1986 2. NUMBER OF SAMPLES TESTED: One (Run	111)	
3. BREAKTHROUGH TIME: 146 min.		
4. MIN DETECTABLE LIMIT 0.09 ppm	<del></del>	
	ug/cm hour	<del> </del>
6. SAMPLE THICKNESS: 17-19 mil	ag/ ciii 110a1	
7. SELECTED DATA POINTS		
	: CONCENTRATION	: CONCENTRATION
1 <u>:</u>	CONCENTRATION	CONCENTRATION
2. <u>:</u> : : : : : : : : : : : : : : : : : :		•
3. :	<u> </u>	<u>:</u>
5. :	•	
6. :		<u>:</u>
8. :	•	·
9.		<del>:</del>
10		
8. OTHER OBSERVATIONS:		
SOURCE OF DATA		
Sample was run by Karen Verschoo	r on April 30, 1986.	

# Chemical Resistance Testing of USCG Materlal with Tetrachloroethylene

Tetrachloroethylene charged into cells Flow rate to Detector: 100cc/mln Flow rate to cella: 100cc/min Recorder attn: 4

C-249

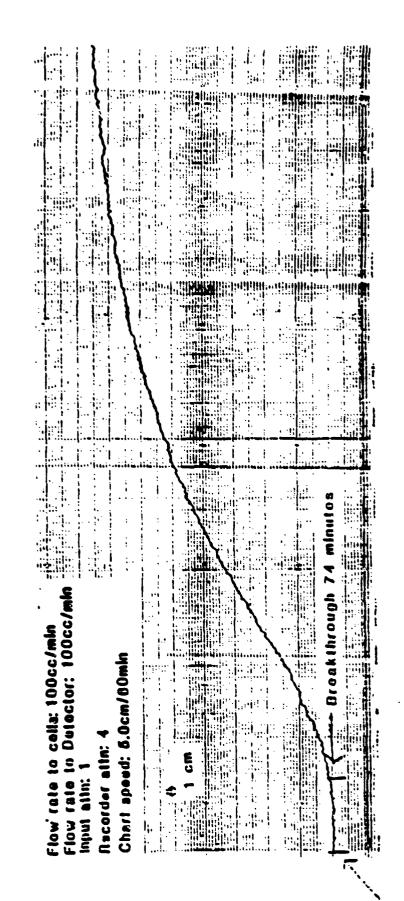
. DE:	SCRIPTION OF PROD	OCT EVALUATED		
1:				
2:	PROTECTIVE MATE			
3:		E TEST: Unused, no v	is(ble imperfection	ns
4:	MANUFACY URER:			
5:		ICATION: Challenge 51	100	
<b>6</b> :				
7: 8:			0004 00 000 0140	ad built colleged on the
0.	other side.	acerial was orange col	ored on one side a	ind buff colored on the
. TE	SIT METHOD			
1.	TESTING LABORAT	ORY: Texas Research I	stitute, 9063 Bee	Caves Road, Austin, TX
2.	ANALYTICAL METH	IOD: <u>Continuous photo</u>	<u>ionization detection</u>	n with a 10.20 eV lamp
3.		25℃	<del> </del>	المارية والمراجع المارية المراجع المارية والمارية والمارية والمارية والمارية والمارية والمارية والمارية والمارية
4.				
5.			· · · · · · · · · · · · · · · · · · ·	
7.	DEVIATIONS FROM	IS: 1 inch cells were ASTM F739 NETHOD: F14	w rate to cells wa	s 100 cc/min.
- CH	ALLENGE CHEMICAL	1 :	COMPONENT 2	: 3
_		_		•
	CHEM NAME (s):		<u> </u>	
		N/A	N/A	
_	CONC. (IF MIX)	:Crown reagent grade	N/A	:N/A
4.	CHEMICAL SOURCE	crown reagent grade	N/A	: N/A
. TES	ST RESULTS			
	DATE TESTED: Ju			
	NUMBER OF SAMPLE			
		IE: No breakthrough was	s observed after 3.	b hours.
	MIN DETECTABLE L			
	SAMPLE THICKNESS	MEATION RATE N/A		<del></del>
	SELECTED DATA PO			
•			· — · · · · · · · · · · · · · · · · · ·	
	TIME 1.	: CONCENTRATION	: CONCENTRATION	: CONCENTRATION
	2.			
	3.		<u>- •</u>	<del></del>
	4	<del>:</del>	<del></del>	
	6.	<u> </u>	<u> </u>	
	<b>7</b> .	•	<del>-:</del>	
	8.	•	<del>- ;</del>	<del></del>
	9.	<del></del>	<u> </u>	
	10.	•	<u> </u>	:
	T	·····		
8.	OTHER OBSERVATIO	INS:		
. \$01	URCE OF DATA			
	Camples were	run by Sylvia Cooper	on July 24, 1986.	
	2 mint 62 MEL			

			<del></del>	
- [1] [1] [1] [1] [1] [1] [1] [1] [1] [1]	7	φ. : : : <del>: : : : : : : : : : : : : : : :</del>		<u> </u>
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	1			
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	٠	7		
		شاهده استیه دهشوی در این . محصور است		
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<b>.</b>				
<b>F</b>				
cc/min				
riin COcc/min				
c/min 100cc/min min				
Occ/min or: 100cc/min iOmin				
100cc/min ctor: 100cc/min u/60min 2 -				
: 100cc/min :tector: 100cc/min cm/80min 32				
Mectactor: 100cc/min Mectactor: 100cc/min 1.0cm/60min				
cells: 100cc/min ) Dectector: 100cc/min 0 : 6.0cm/60min )V				
to cells: 100cc/min to Dectector: 100cc/min : 10 ed: 6.0cm/60min .2eV				
te to cells: 100cc/min te to Dectector: 100cc/min thr: 10 peed: 6.0cm/60min for attn: 32				
rate to cells: 100cc/min rate to Dectector: 100cc/min attr: 10 r speed: 6.0cm/60min x: 10.2eV				
Flow rate to cells: 100cc/min Flow rate to Dectector: 100cc/min is brout attr: 10 Chart speed: 6.0cm/60min Charp: 10.2eV	9			

Turpentine charged into cells

1.	DESCRIPTION OF PRODU	CT EVALUATED		
	1: TYPE: Teflon land			
	2: PROTECTIVE MATER			
	3: CONDITION BEFORE 4: MANUFACTURER: C	TEST: Unused, no v	isible imperfections	<u> </u>
		CATION: Challenge 5.	100	
	6: LOT OR MANUFACTU	RER DATE: N/A		
	7: NOMINAL THICKNES			
	8: DESCRIPTION: Ma	terial was orange co	lored on one side and	buff colored
	on the other si	de.		
2.	TEST METHOD			
	1. TESTING LABORATO	RY: Texas Research I	nstitute, 9063 Bee Ca	ves Road, Austin, TX
	2. ANALYTICAL METHO	D: Continuous photo	ionization detection	with a 11.7 eV Tamp.
	3. TEMPERATURE: 22-			
	4. COLLECTION MEDIU 5. COLLECTION SYSTE	M. No		
	6. OTHER CONDITIONS	: 2 inch calls war	e used./ Detector Ter	mperature = 60C
	7. DEVIATIONS FROM	ASTM F739 METHOD: F	low rate to cells was	100cc/min.
			100 100 10 00130 00	200647111111
3.	CHALLENGE CHEMICAL	1	COMPONENT 2	3
	1. CHEM MAME(s):	Vinvl Acetate	1 /A	N/A
	2. CAS NUMBER(s):		N/A	N/A
	3. CONC. (IF MIX)	N/A	N/A	: <b>ħ</b> /A
	4. CHEMICAL SOURCE:	Aldrich reagent	: N/A	: N/A
		grade	. <u>N/A</u>	:N/A
4.	TEST RESULTS			·•
	1. DATE TESTED: Ma	v 13 1006		
	2. NUMBER OF SAMPLES			
	3. BREAKTHROUGH TIME			
	4. MIN DETECTABLE LI	MIT 0.21 ppm.		
	5. STEADY STATE PERM	EATION RATE 3.30ug	/cng/hr	
	6. SAMPLE THICKNESS:	17-19 mil		
	7. SELECTED DATA POI	NTS		
	TIME :	CONCENTRATION	: CONCENTRATION	: CONCENTRATION
	ž: <del>-</del>		<del></del>	<del>:</del>
	3.		<u>:</u>	•
	4.			:
	5:			:
	6:			:
	7·:	والأكاري والمتالاة المستوي والمتالوات المورودات	<u>:</u>	
	8			<u> </u>
	9: 10.			<u> </u>
	10			<u> </u>
	8. OTHER OBSERVATION	S:	;	
_	60 mor 42 6474			-
٥.	SOURCE OF DATA		May 12 1006	
	5amples were	run by karen versch	oor on May 13, 1986.	

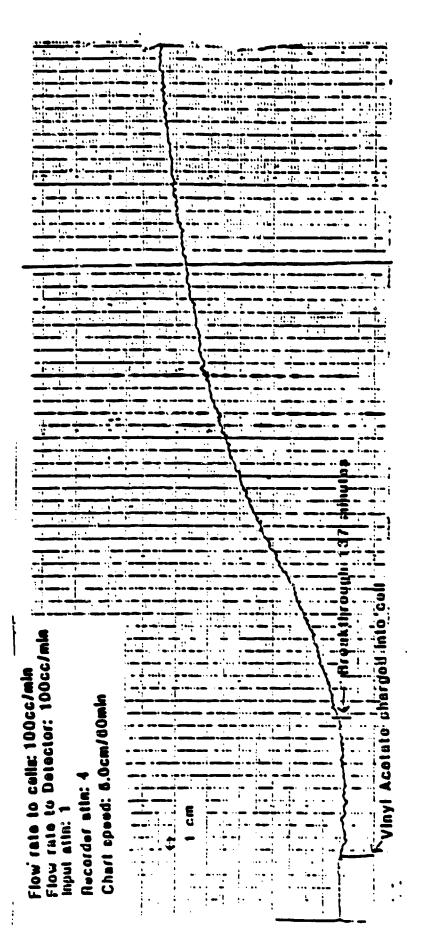
## Permeation of Vinyl Acetate through USCG Material Composite Run



Cyl Acetate charged into cells

DESCRIPTION OF PRODUCT EVALUATED		
1: TYPE: Teflon laminated Homex		
2: PROTECTIVE MATERIAL CODE: 068		
3: CONDITION BEFORE TEST: Unused, no	visible imperfection	IS
4: MANUFACTURER: Chemfab Corp.		
5: PRODUCT IDENTIFICATION: Challenge	5100	
6: LOT OR MANUFACTURER DATE: N/A		
7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was buff col		
o: EESCRIPTION: Material was built col	orea	
. TEST METHOD	•	
1. TESTING LABORATORY: Texar Research		
2. ANALYTICAL METHOD: Continuous phot 3. TEMPERATURE: 22-25 C	colonization detection	on with a 11.7 eV lamp.
4. COLLECTION MEDIUM: No		
5. COLLECTION SYSTEM: No		
6. OTHER CONDITIONS: 2 inch cell's we	ere used. / Detector T	emperature = 60C.
7. DEVIATIONS FROM ASTM F739 METHOD:	Flow rate to cell wa	is 100 cc/min
. CHALLENGE CHEMICAL 1	: COMPONENT 2	<b>3</b>
1. CHEM MANE(s): Vinyl Acetate	1/A	N/A
2. CAS NUMBER(s): 108-05-4	N/A	N/A
3. CONC. (IF MIX) N/A		N/A
4. CHEMICAL SOURCE: Aldrich reagent grade	: N/A : N/A	N/A N/A
TEST RESULTS .		<u>N/A</u>
1. DATE TESTED: May 21, 1986		
2. NUMBER OF SAMPLES TESTED: one (Run	1)	
3. BREAKTHROUGH TIME: 137 min.		
4. MIN DETECTABLE LIMIT 0.21 ppm.		
5. STEADY STATE PERMEATION RATE 3.73	ug/cmhour	
6. SAMPLE THICKNESS: 18-20 m.		
7. SELECTED DATA POINTS		
TIME : CONCENTRATION	CONCENTRATION	: CONCENTRATION
1. 136 min : 0.0 ppm 2. 195.6 min : 1.57 ppm		
2. 195.6 min : 1.57 ppm 3. 756 min : 3.59 ppm	<del>-</del>	
4. : 3.35 50m		
5.		- <del>-</del>
6.	<del></del>	<del></del>
7.		•
8.	•	
9. —————		:
10. :		:
8. OTHER OBSERVATIONS:		
The state of the s		
SOURCE OF DATA		
Sample was run by Karen Verscho	or on May 21, 1986	

Permeation of Vinyl Acetate through USCG Material Run 1



	CENTA	CAL PROTECTIVE CLOS	HING PROPUCT EVALUAT	LAN DECABL
	CRE	CAL PROTECTIVE CECT	HING PROPECT EVALUAT.	TOR RECORD
1.	DESCRIPTION OF PROP	CO EVALUATED		
	1: TYPE: Teflon las	mineted Nomes		
	2: PROTECTIVE MATE		<del></del>	
	=		visible imperfection	
	4: MANUFACTURER: (	Chamfal Corn	Visible impeliection	15
	5: PRODUCT IDENTIF		5100	
	6: LOT OR MANUFACTI	TREE DATE: N/A	3100	
	7: NOT NAL THICKNE		<del></del>	
			culored on one side	and buff colored on the
	other side.			
2.	TEST METHOD			
	1. TESTING LABORAT	ORY: Texas Research	Institut =, 4063 Bee	Caves Road, Austin, TX
	2. ANALYTICAL METH	DD: Continuous pho	toionizat on detection	on with a 10.20 eV lamp.
	3. TEIPERATURE: 22			
	4. COLLECTION MEDI			
	5. COLLECTION SYST	EM: No		
	6. OTHER CONDITIONS	S: linch cell wa	s used./Detector Tem	perature = 100C.
	7. DEVIATIONS FROM	AST: F739 METHOD:	Flow rate to cell we	s 100 cc/min.
3.	CHALLENGE CHEMICAL	1	: Component 2	: 3
	1. CHEM NAME (s):	Vinul Acatata	: : N/A	: N/A
	2. CAS NUMBER(s):	108-03-4	-: N/A	N/A
	3. CONC. (IF MIX)	N/A	-: N/A	N/A
	4. CHEMICAL SOURCE		-: N/A	N/A
	4. OHEHICAE SOURCE	MIGITOR		
4.	TEST RESULTS			
	1 DATE MEGTER. 1			
	1. DATE TESTED: 1-9		-33	
	2. NUMBER OF SAMPLE		111)	
	3. BREAKTHROUGH TIM			
	4. MIN DETECTABLE L			
	5. STEADY STATE PER	EATION RATE 0.46	ug/cm²/hr	
	6. SAMPLE THICKNESS			
	7. SELECTED DATA PO	INTS N/A		
	***	00.1100.1100.400.400		
	TIME	: CONCENTRATIO	ON : CONCENTRATION	N : CONCENTRATION
	1	·		
	2.	<u> </u>		
	3.	<u>:</u>		
	4.	<u> </u>	<u> </u>	:
	5.	<u> </u>	<u> </u>	:
	6.	<u> </u>		:
	7.	•	•	:

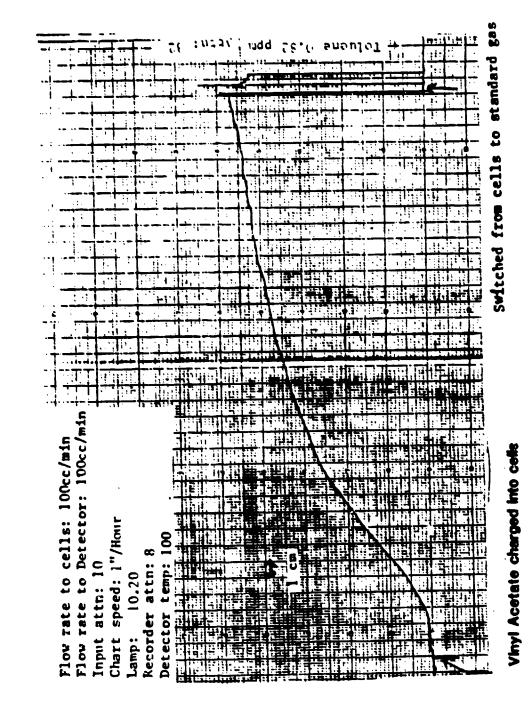
Sample was run by Denis McDonald on January 9, 1987.

8. OTHER OBSERVATIONS:

SOURCE OF DATA

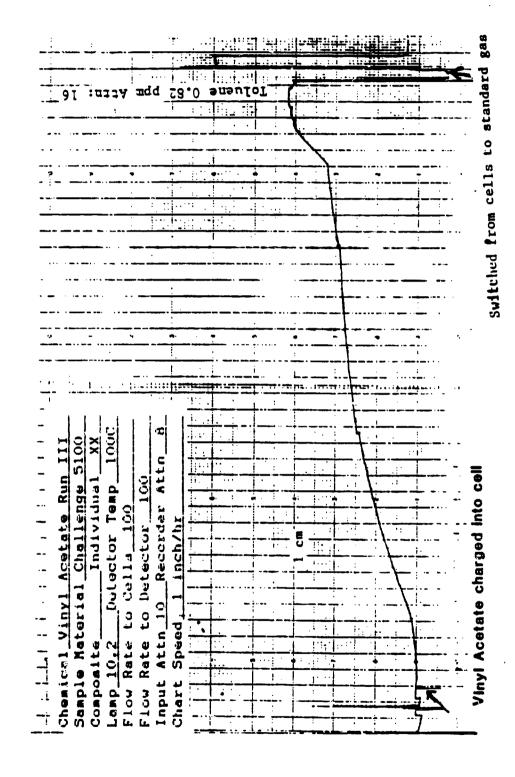
## Chemical Resistance Testing of Challenge 5100

### Vinyl Acetate Run II



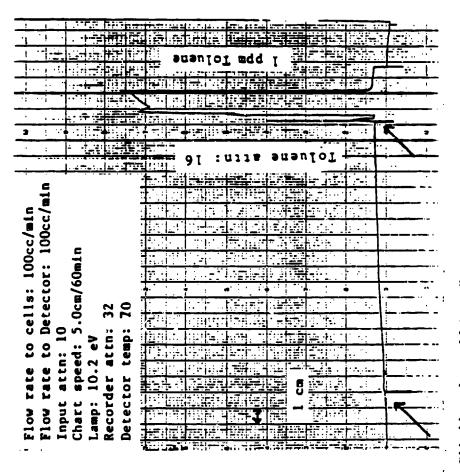
DE	SCRIFTION OF PRODUCT	EVALUATED			
1:					
2					
3			isible imperfectio	ns .	
4					
5	PRODUCT IDENTIFICA	TION: Challenge 5	100		
6	LOT OR MANUFACTURE	R DATE: N/A			
7 :	NOMINAL THICKNESS:	15-20 mil			
8	: DESCRIPTION: Mate	rial was orange co	lored on one side	and buf	colored on th
	other side.				
Ţ	EST METHOD				
ì.	TESTING LABORATORY	: Tayas Rasaarch I	netitura 9063 Rea	Cayes F	land Augein 1
2.			ionization detecti		
3.			TONIZACION GELECCI	OIL WALL	# 10.20 EV 14
4.					
5.				<del> </del>	
			-4/D		1000
6.		THEN COLL MAS HE	ed/vetector Temper	TOP	1000.
. •	OF THE CONTRACT AND AND	in 1739 Milanob. 31	ON LUIS TO CATT AN	I TOUCE.	31.7%
בי	HALLENGE CHEMICAL	1	: COMPONENT 2	=	3
1.	CHEM NAME(s): Vi	nvl Acerste	: N/A	•	N/A
		8-05-4	N/A	:	<u>N/A</u>
3.			N/A	:	N/A
4.			N/A	:	N/A
	-	41.40.1			
T	ST RESULTS				,
1.	DATE TESTED: 2-24-	87			
2.	. NUMBER OF SAMPLES T	ESTED: One (Run II	1)		<del></del>
	BREAKTHROUGH TIME:				
	MIN DETECTABLE LIMI				
	STEADY STATE PERMEA		/cm2*hr)		
	SAMPLE THICKNESS: 1		, , , , , , , , , , , , , , , , , , , ,		
_	SELECTED DATA POINT				
, ,	-				
	TIME :	CONCENTRATION	: CONCENTRATIO	N : (	CONCENTRATION
	:		<u>:</u>	:	
	2.		<u>.</u> :		<del> </del>
	3.		:	<u> </u>	· · · · · · · · · · · · · · · · · · ·
	4.		:	<u> </u>	
	5		:	:	
	6		:	:	
	7		:	:	
			•	:	
	8.				
	8.		:	•	
			:	<u> </u>	
•	9. :		:		
8.	9.		:		
	9. : 10. : OTHER CBSERVATIONS:				
	9. : 10. : OTHER OBSERVATIONS:		:		
	9. : 10. : OTHER OBSERVATIONS:		: : on February 24, 198	37.	
	9. : 10. : OTHER OBSERVATIONS:		: in February 24, 198	37.	

### Chemical Resistance Testing of Challenge 5100 , Vinyl Acetate Run III



	1: TY	PE: Teflon la	uct EVALUATED		
	3: CO 4: MA	NDITION BEFOR	RIAL CODE: 068 RE TEST: <u>Unused, no v</u> Chemfab Corp. ICATION: Challenge 5		
	6: L0 7: NO	T OR MANUFACT MINAL THICKNE	URER DATE: N/A SS: 15-20 mil	lored on one side and	buff colored on the
_	_0	ther side.			
2.	TEST M		ODY. Towns Dosesmon I	matitute ONES Pas Co.	une Dead Austin TV
•	2. AN 3. TE	ALYTICAL METH MPERATURE: 22	IOD: <u>Continuous photo</u> 2-25°C	nstitute, 9063 Bee Cavionization detection v	with a 10.2 eV lamp.
	5. CO	LLECTION MEDI	EM: N2		
	7. DE	VIATIONS FROM	S: 1 Inch cells were ASTN F739 METHOD: F	used./ Detector Tempo law rate to cells was	100cc/min.
3.	.CHALLE	NGE CHEMICAL	1 .	: COMPONENT 2	3
	1. CH	EM NAME (s) :	Vinylidene Chloride		N/A
	3. CO	S NUMBER(s): NC. (IF MIX)	N/A	N/A N/A	N/A N/A
	4. CH	EMICAL SOURCE	:Aldrich	. N/A	N/A
	3. BRE 4. MIN 5. STE 6. SAM	AKTHROUGH TIM DETECTABLE L	IMIT .49 ppm MEATION RATE N/A : 19-20 mil		
	1	TIME	: CONCENTRATION	: CONCENTRATION	CONCENTRATION
	2.				
	3. ] 4.		•		· · · · · · · · · · · · · · · · · · ·
	5.				
	6. 7.		7		
	8. Ì			:	
	10.		<u> </u>		
	8. OTH	ER OBSERVATIO	NS:		
5.	SOURCE	OF DATA Samples were	run by Denise McDona	ld on September 23, 19	986

# Chemical Resistance Testing of USCG Material with Vinylidene Chloride

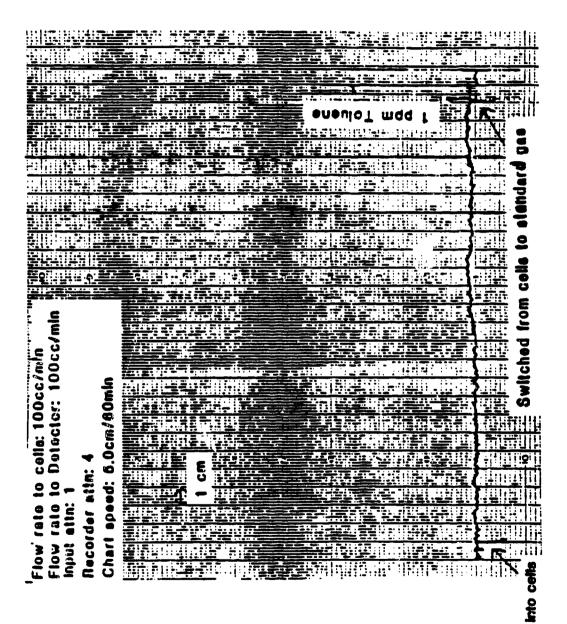


Vinylidene Chloride charged into cells

Switched from cells to standard gas

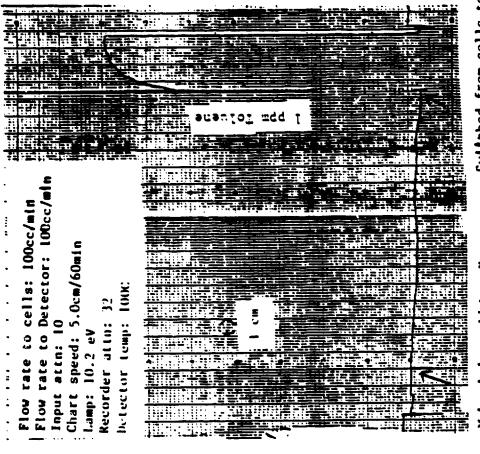
DESCRIPTION OF PRODU	UCT EVALUATED		
2: PRUTECTIVE MATE 3: CONDITION BEFOR 4: MANUFACTURER: ( 5: PRODUCT IDENTIF 6: LOT OR MANUFACT 7: NOMINAL THICKNE	RIAL CODE: 068 E TEST: Unused, no v Chemfab Corp. ICATION: Challenge 5 URER DATE: N/A SS: 15-20 mil	100	
TEST METHOD			•
2. ANALYTICAL METHO 3. TEMPERATURE: 22: 4. COLLECTION MEDION 5. COLLECTION SYST 6. OTHER CONDITION	OD: Continuous photo -25°C UM: N <sub>2</sub> EM: N <sub>2</sub> S: 2 inch cells were	ionization detection used./ Detector Tem	on with a 11.7 eV lamp
CHALLENGE CHEMICAL	1	: COMPONENT 2	: 3
2. CAS NUMBER(s): 3. CONC. (IF MIX)	1330-20-7 Mixed Isomers :Baker	N/A N/A N/A N/A	N/A N/A • N/A N/A N/A
TEST RESULTS	Reagence of ade	·	<u> </u>
2. NUMBER OF SAMPLES 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PER 6. SAMPLE THICKNESS	S TESTED: Three E: No breakthrough wa IMIT 0.13 opm. MEATION RATE N/A : 18-20 mil	s observed after th	nree hours.
TIME 1.	: CONCENTRATION	: CONCENTRATION	CONCENTRATION
2.			
4	<u>:</u>		
5.	:		
7.			
	:		•
10	•		
8. OTHER OBSERVATIO	NS:		
	1: TYPE: Teflon la 2: PRUTECTIVE MATE 3: CONDITION BEFOR 4: MANUFACTURER: 5: PRODUCT IDENTIF 6: LOT OR MANUFACT 7: NOMINAL THICKNE 8: DESCRIPTION: MOTHER SIDES.  TEST METHOD  1. TESTING LABORAT 2. ANALYTICAL METH 3. TEMPERATURE: 22 4. COLLECTION MEDI 5. COLLECTION MEDI 5. COLLECTION SYST 6. OTHER CONDITION 7. DEVIATIONS FROM  CHALLENGE CHEMICAL  1. CHEM NAME(s): 2. CAS NUMBER(s): 3. CONC. (IF MIX) 4. CHEMICAL SOURCE  TEST RESULTS  1. DATE TESTED: Jun 2. NUMBER OF SAMPLE 3. BREAKTHROUGH TIM 4. MIN DETECTABLE L 5. STEADY STATE PER 6. SAMPLE THICKNESS 7. SELECTED DATA PO  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	2: PRUTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no v 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange co other side.  TEST METHOD  1. TESTING LABORATORY: Texas Research I 2. ANALYTICAL METHOD: Continuous photo 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION MEDIUM: N2 6. OTHER CONDITIONS: 2 inch cells were 7. DEVIATIONS FROM ASTM F739 METHOD: F1  CHALLENGE CHEMICAL 1  1. CHEM NAME(s): Xylene 2. CAS NUMBER(s): 1330-20-7 3. CONC. (IF MIX) Mixed Isomers 4. CHEMICAL SOURCE: Baker Reagent Grade  TEST RESULTS  1. DATE TESTED: June 2, 1986 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough wa 4. MIN DETECTABLE LIMIT 0.13 ppm. 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 18-20 mil 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 9. :	1: TYPE: Teflon laminated Nomex 2: PRUTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfection 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange colored on one side a other side.  TEST METHOD 1. TESTING LABORATORY: Texas Research Institute, 9063 Bee chem side.  TEST METHOD 2. ANALYTICAL METHOD: Continuous photoionization detection at the second

(-262-



1.	DESCRIPTION OF PRODUCT EVALUATED		
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no	visible imperfections	
	4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge	EVO	
	6: LOT OR MANUFACTURER DATE: N/A	: 3100	
	7: NOMINAL THICKNESS: 15-20 mil		
	8: DESCRIPTION: Material was orange	colored on one side and	buff colored on the
	other side.		
2.	TEST METHOD		
	1. TESTING LABORATORY: Texas Research	Institute, 9063 Bee Cav	es Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous pho 3. TEMPERATURE: 22-25°C	toionization detection w	ith a 10.20 eV lamp.
	4. COLLECTION MEDIUM: No		
	5. COLLECTION SYSTEM: N2		
	6. OTHER CONDITIONS: I inch cells w	ere user. Detector Temp	erature = 100C.
	7. DEVIATIONS FROM ASTM F739 METHOD:	Flow rute to cells was	100 cc/min.
3.	CHALLENGE CHEMICAL 1	: COMPONENT 2 :	3
	1. CHEM NAME(s): Xylenol	: N/A :	N/A
	2. CAS NUMBER(s): 576-26-1	: N/A :	N/A
	3. CONC. (IF MIX) N/A	: <u>N/A</u> :	N/A
	4. CHEMICAL SOURCE: Aldrich	: N/A :	N/A
4.	TEST RESULTS		
	1. DATE TESTED: <u>September 9, 1986</u> 2. NUMBER OF SAMPLES TESTED: Three		
	3. BREAKTHROUGH TIME: No breakthrough	was observed after 3.26	hours.
	4. MIN DETECTABLE LIMIT .01 ppm as Cr	esol.	100131
	5. STEADY STATE PERMEATION RATE N/A	. <del></del>	
	6. SAMPLE THICKNESS: 19-20 mil		
	7. SELECTED DATA POINTS N/A		
	TIME : CONCENTRATIO	N : CONCENTRATION :	CONCENTRATION
	2:	•	
	3.	<del></del>	
	5.	<del>- :</del>	
	6.	<del>:</del>	
	7	:	
	8:	:	
	9.	<u> </u>	
	10		
	8. OTHER OBSERVATIONS:		
5.	SOURCE OF DATA Samples were run by Denise McDo	onald on September 9, 198	6

## Chemical Resistance Testing of USCG Material with Xylenol



Xylenol charged into cells

Switched from cells to standard gas

(-26.

### APPENDIX D

### METHOD FOR CREASING MATERIAL SAMPLES

(Provided by Chemical Fabrics Corporation)

Rough Draft
\*\*CHEMFAB Test Procedure

O5 September 1986

### Fold Resistance of CHEMFAB Protective Clothing Material

### SCOPE:

CHARLES

To evaluate the reduction of chemical permeation resistance of chemical protective clothing material due to hard folding or creasing.

### SAMPLE PREPARATION:

Cut a rectangular section of material, 4" x 8", with the long dimension parallel to the warp or machine-direction of the material.

### TEST EQUIPMENT:

- 1.) Steel roller 1.50" diameter x 2.25 " length, 10 lb. "al weight (Fig. 1)
- 2.) Permeation test apparatus consistent with ASTM 739-81.

### PROCEDURE:

- Wipe sample with damp cloth to remove any surface dust or abrasive particles which may damage the sample during rolling.
- 2.) Fold sample perpendicular to long dimension.
- 3.) Place the folded sample on a hard surface such as a clean lab bench top, metallic or formica table top.
- 4.) Roll the sample with the ten pound roller so that the direction of the roll is parallel to the sample fold (Fig. 2).
- 5.) Repeat Step 4 nine (9) times for a total of ten (10) rolls.

Page Two Rough Draft CHEMFAB Test Procedure O5 September 1986

### Fold Resistance of CHEMFAB Protective Clothing Material

- 6.) Reverse the fold, taking care to insure that the new fold occurs along the same line as the original fold (Fig. 3).
- 7.) Repeat Steps 4 and 5.
- 8.) Cut permeation test sample so that the fold line bisects the exposed area in the test cell.
- 9.) Perform permeation testing (ASTM 739-81) toward chemical of choice.

### RESULTS:

Report breakthrough time and permeation rate of folded samples and pristine control samples. Report all parameters required by ASTM 739-81 including chemical(s) type and concentration.

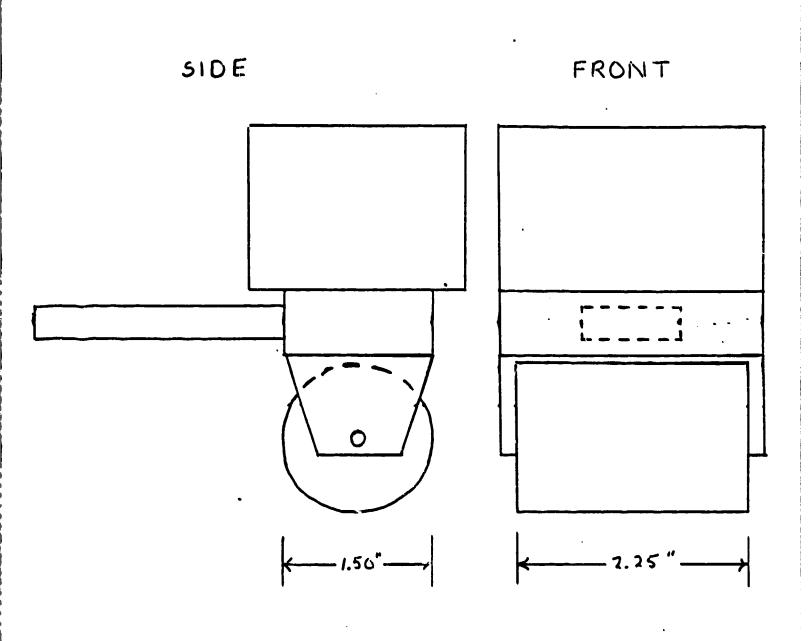


FIG. 1. STEEL ROLLER, TOTAL WEIGHT 10 LB

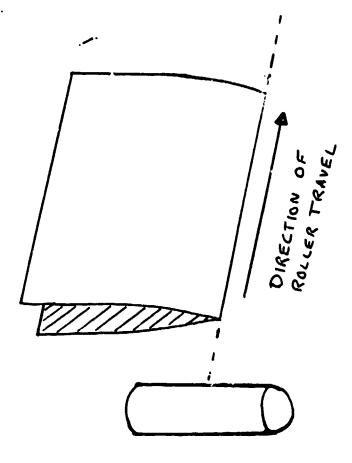
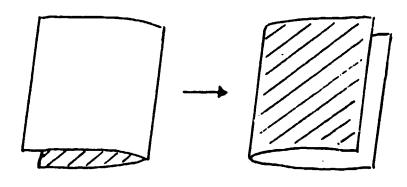


Fig. 2.



F16. 3.

### APPENDIX E

PERMEATION TEST DATA FOR CREASED GARMENT MATERIAL SAMPLES

(Data Provided by Texas Research Institute Under Contract)

D	ESCRIPTION OF PROLUCT EVALUATED		
1	: TYPE: Teflon lawinated Nomex		
	PROTECTIVE MATERIAL CODE: 068		
_	: CONDITION BEFORE TEST: Unused, no	visible imperfections	
4			
5	<del>مستوان مرازين بين من مستوان منبيودكان بالبران بالبران بالبران بالبران بالبران بالبران بالبران بالبران بالبران با</del>	5100	
6	: LOT OR MANUFACTURER DATE: N/A		
	: NOMINAL THICKNESS: 15-20 mil		
	: DESCRIPTION: Material was orange	colored on one side an	d buff colored on the
	other side. Sample was creased us:		
	of 5 September 1986.		
T	EST METHOD		
1.	. TESTING LABORATORY: Texas Research	Institute, 9063 Bee C	aves Road, Austin, TX
2.	. ANALYTICAL METHOD: Continuous pho	toionization detection	with a 10.20 eV lamp
3.	• TEMPERATURE: 22-25°C		
4.	. COLLECTION MEDIUM: No		
3.	. COLLECTION SYSTEM: No		
6	. OTHER CONDITIONS: 1 inch cells w	as ised. /Detector Temp	erature = 100 C.
7.	. DEVIATIONS FROM ASIM F739 METHOD:	Flow rate to cells wa	s 100 cc/min-
7	HALLENGE CHEMICAL 1	: COMPONENT 2	: 3
1.	. CHEM NAME(s): Acetone	: : N/A	: : N/A
	. CAS NUMBER(s): 67-64-1	: N/A	: N/A
	. CONC. (IF MIX) N/A	: N/A	: N/A
	. CHEMICAL SOURCE: Mallinckrodt	: N/A	: N/A
2 3 4, 5	. DATE TESTED: 2-23-87 . NUMBER OF SAMPLES TESTED: Three . BREAKTHROUGH TIME: N/A . MIN DETECTABLE LIMIT .09 ppm . STEADY STATE PERMEATION RATE N/A . SAMPLE THICKNESS: 19-20 mils		
7.	. SELECTED DATA POINTS N/A	<del></del>	
	TIME : CONCENTRATION	N : CONCENTRATION	: CONCENTRATION
	1.	<del></del>	
	2. :	<u>:</u>	
	3.		_ <del></del>
	4.		<u> </u>
	5:		<u>:</u>
	6. :	<del></del>	· · · · · · · · · · · · · · · · · · ·
	7.	<del></del>	:
	8.	:	:
	9		:
	10:	:	:
8.	OTHER OBSERVATIONS:		
sc			
SC	DURCE OF DATA		
	Samples were run by Denise McDo	nald on February 23,	1987.

## Chemical Resistance Testing of Creased 5100

Acetoné

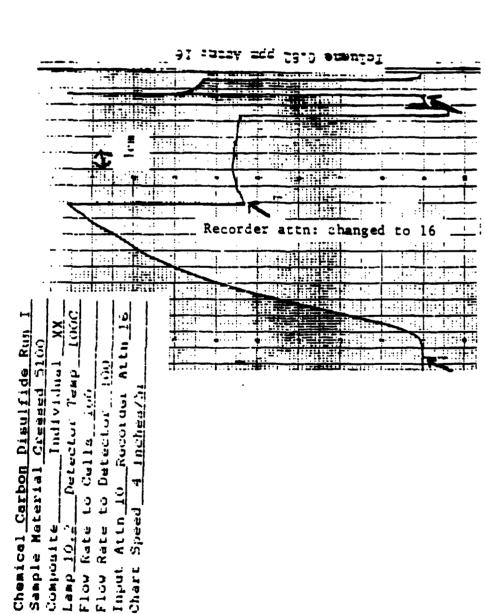
	Toluene 0.82 ppm Attn: 16	
		,5
3 3		**
d. 5100 al. p. 400 100 Attn_fi		
1 1 2 2 3 1		
141 Cre X Indiv Detector Cells Detector		
<b>┦→                                    </b>		3
Sampl Sampl Compo Lamp Flow Input		F

_								
1:	الأن الأن الأن الأن الإن الإن الإن الأن الأن الأن الأن الأن الأن الأن الأ							
2:	PROTECTIVE MATE							
3:		E TEST: Unused, no v	visible imperfection	i S				
4:								
5:		ICATION: Challenge 5	100					
6:	LOT OR MANUFACT							
7:	NOMINAL THICKNE		·					
8:		aterial was orange co						
		mple was creased usin	ng CHEMFAB Fold Resi	stance	Test procedure			
	of 5 September	1986.						
TE	ST METHOD							
1.		ORY: Texas Research 1		Caves	Road, Austin, T			
2.	ANALYTICAL METH	OD: Gas Chromatograp	hy					
3.	TEMPERATURE: An	bient						
4.	COLLECTION MEDI	UM: Charcoal						
5.	COLLECTION SYST	EM: Charcoal						
6.	OTHER CONDITION		e used.					
7.	DEVIATIONS FROM	ASIM F739 METHOD:						
CH.	ALLENGE CHEMICAL	1	: COMPONENT 2	:	3			
1.	CHEM WAME (s) :	Acetonitrile	: N/A	:	n/a			
2.		2206-26-0	N/A	;	N/A			
		N/A	N/A	—:—	N/A			
4.		: Fisher-Pesticide	: N/A	: <u>-</u>	N/A			
→•	OHEMICAL SOURCE	Grade	-: N/A	<b></b> ;	N/A			
TE!	ST RESULTS	OTAGE		—·-	N/R			
	DATE TESTED: 2-			<del></del> -				
	NUMBER OF SAMPLES TESTED: Three							
	BREAKTHROUGH TIME: N/A							
	MIN DETECTABLE L							
	STEADY STATE PER				<del></del>			
	SAMPLE THICKNESS: 19-20 mil SELECTED DATA POINTS Cells 1,2, and 3 at end of three hour test							
7.	SELECTED DATA PO	INTS Cells 1,2, and	3 at end of three h	our to	est			
	TIME	: CONCENTRATION	: CONCENTRATION	· :	CONCENTRATION			
	1. 3 hours	: <0.6 ррш	: <0.6 ppm	:	<0.6 ppm			
	2.	•	•	:				
	3.		:	:				
	4.	:	:					
	5.	•	:	:				
	6.	:	:	:				
	7.	:	:	:	•			
	.8.	•	<del></del>	:				
	9.	:	:	:				
	10.	:	:	<del></del> -	<del></del>			
		<del></del>	· · · · · · · · · · · · · · · · · · ·	<del></del>	<del></del>			
8.	OTHER OBSERVATION	ONS:			<del></del>			

1.	DES	CRIPTION OF PROD	UCT EVALUATED			
	1:	TYPE: Teflon la	minated Nomex			
	2:	PROTECTIVE MATE				
	3:		E TEST: Unused, no v	isible imperfectio	ns	
	4:	MANUFACTURER:		100		
		LOT OR MANUFACT	ICATION: Challenge 5	100		<del></del>
	7:	NOMINAL THICKNE		<del></del>	·	
	8:		aterial was orange co	lored on one side	and buff co	lored on the
			mple was creased usin			
		of 5 September	1986.			
2.	TES	T METHOD				
	1.	TESTING LABORAT	ORY: Texas Research I	institute, 9063 Bee	Caves Road	, Austin, TX
	2.	ANALYTICAL METH	OD: Continuous photo	ionization detecti	on with a l	0.20 eV lamp.
	-	TEMPERATURE: 22				
		COLLECTION MEDI		<del></del>		<del></del>
		COLLECTION SYST	S: linch cell was	wood /Donners Tree		1000
	-	DEVILTIONS FROM	ASIM F739 METHOD: F	low rate to call w	merature =	1000.
	•	22 - 222 20 ·· 2 · 1.011		10. IELE LO CEII 4	as 100 CC, 1	
3.	Cila	LIENGE CHEMICAL	1	: COMPONENT 2	<b>:</b>	3
	1.	CHEM NAME(s):	Carbon Disulfide	: N/A	:	N/A
		CAS NUMBER(s):		: N/A		N/A
		CONC. (IF MIX)		: N/A		N/A
	4.	CHEMICAL SOURCE	:Fisher	:N/A	:	N/A
4.	TES	T RESULTS				
		DATE TESTED: 2-				
			S TESTED: One (Run 1	.)		
		BREAKTHROUGH TIM				
	5	MIN DETECTABLE L	MEATION RATE 13.33 (	'ug/om2#h=\		
	6.	SAMPLE THICKNESS	: 19-20 mil	ug/cm ~nr/		
-		SELECTED DATA PO				<del></del>
		•	: CONCENTRATION	: CONCENTRATIO	)N : CO NO	ENTRATION
		2.	:		<del></del>	
			:	:	:	<del></del>
		·	:		:	
		5.	:	:	:	
		6.	<u>:                                      </u>		<del>:</del>	
		7. 8.	<u>:</u>		<del>:</del>	<del> · </del>
		9.	:	•	<del></del>	
		10.	•		:	
	8. (	OTHER OBSERVATION	NS •			
	J	VSU-N'R11U	····			
		<del></del>				
5.	sou	RCE OF DATA				
		Sample was r	un by Denise McDonald	on February 19, 1	987.	
						· ·

## Chemical Resistance Testing of Creased 5100

## Carbon Disulfide Run I



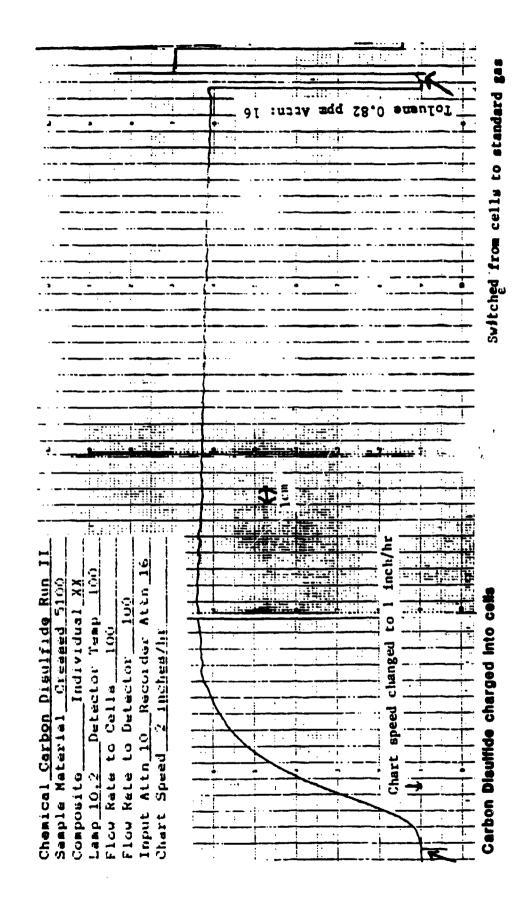
Carbon Disulfide charged into cells Switched

Switched from cells to standard gas

DE	SCRIPTION OF	PRODUCT E	VALUATED					
1:	TYPE: Tef1	on laminate	ed Nomex					
2:								
3:	CONDITION	BEFORE TEST	I: Unused, no v	visible	imperfection	5		
4:								
5:			ON: Challenge	100				
6:					<del></del>			
7 :	NOMINAL TH	ICKNESS:	15-20 mil		······································			
8:	DESCRIPTIO	N: Materi	al was orange co	olored	on one side a	nd b	iff colored on th	
		DESCRIPTION: Material was orange colored on one side and buff colored on the other side. Sample was creased using CHEMFAB Fold Resistance Test procedure						
	of 5 Sept	ember 1986	•					
77	ST METHOD							
1.							Road, Austin, T	
2.				pioniza	tion detection	n Wi	th a 10.20 eV lam	
3.					<del></del>			
4.								
5.							سنميونيس فمباد ماجوب	
5.			l inch cell was	used.,	Detector Temp	erati	re = 100C.	
7.	DEVIATIONS	FROM ASIM	F739 METHOD:	low ra	te to cell wa	s 10	O cc/min.	
CH	ALLENGE CHEM	ICAL	1	: 00	MPONENT 2	:	3	
1.	CHEM NAME (	-) · Cb	a Diaulfida	•	N/A	•	N/A	
	CAS NUMBER			-:		-:-	N/A	
			) <del>-</del> U	_:	N/A	— <u>:</u> —		
4.	CONC. (IF CHEMICAL S	·		-!	N/A	<b></b> !	N/A	
٠.	CHEMICAL S	OURCE: FISH	er	_·	N/A	—·–	N/A	
TE	ST RESULTS							
	DATE TESTED							
			TED: One (Run	II)				
3.	BREAKTHROUG	H TIME: 1	l minutes					
4.	MIN DETECTA	BLE LIMIT	.07					
5.	STEADY STAT	E PERMEATI	ON RATE 12.85(	ug/cm2*	hr)			
6.	SAMPLE THIC	KNESS: 19	-20 mils					
7.	SELECTED_DA	TA POINTS	N/A					
	TIME	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION	
	1.				<del></del>	<u> </u>		
	2.			<u>:</u>		<u> </u>		
	3.			<b>:</b>				
	<b>4.</b>	<u> </u>				:	-, <del></del>	
	5.	<u> </u>	<u></u>			:		
	6	<del>:</del>		<del>:</del>	<del></del>	<u>:</u>		
	7.	<u> </u>		:		<u>:</u>		
	8.	<u> </u>		<del>:</del>		<u>:</u>		
	9.	:		:		:		
	10.	:		:		:		
8.	OTHER OBSER	VATIONS:						
8.	OTHER OBSER	VATIONS: _				····		

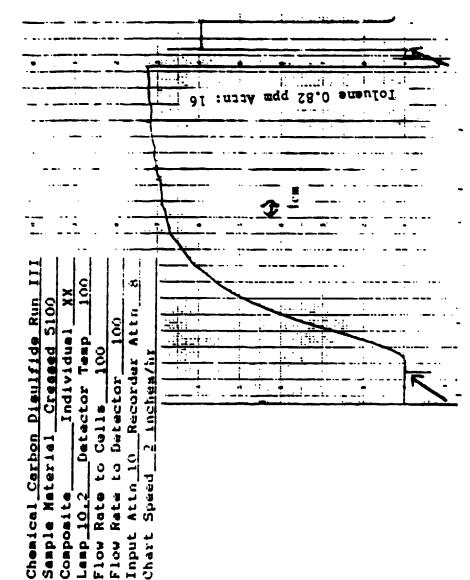
### Chemical Resistance Testing of Creased 5100 Carbon Disulfide Run II

=



1. D	ESURIPTION OF PRO	DOUCT EVALUATED		
1	: TYPE: Teflon	laminated Nomex		
2	: PROTECTIVE MA	TERIAL CODE: 068		
3	: CONDITION BEFO		isible imperfections	_
4	: MANUFACTURER:	Chemfab Corp.		<del></del>
5	: PRODUCT IDENT	FICATION: Challenge	100	
6	: LOT OR MANUFAC	TURER DATE: N/A		
7	: NOMINAL THICK	ESS: 15-20 mil		<del></del>
8	: DESCRIPTION: _	Material was orange co	lored on one side and	buff colored on the
	other side.	ample was creased usin	g CHEMFAB Fold Resista	nce Test procedure
	of 5 September	r 1986.		
2. I	EST METHOD			
_	. TESTING LABOR	ATORY: Texas Research 1	Institute, 9063 Bee Cav	es Road, Austin, TX
2	· · · · · · · · · · · · · · · · · · ·		ionization detection w	ith a 10.20 eV lamp.
	. TEMPÉRATURE:			
4				
5				
÷			used/Detector Temperat	ure = 100C.
7	. DEVIATIONS FRO	M ASIM F739 METHOD: _ E	low rate to cell was l	00 cc, min.
3. 0	ENTENCE CEMICA	. 1	: COMPONENT 2 :	3
1	. CHEM NAME(s)	Carbon Disulfide	N/A	N/A
	. CAS NUMBER(s):		: N/A :	N/A
3	. CONC. (IF MIX)		: N/A :	N/A
4	. CHEMICAL SOUR	E:Fisher	: N/A :	N/A
2 3 4 5 6	DATE TESTED: 2 NUMBER OF SAMPI BREAKTHROUGH TO MIN DETECTABLE STEADY STATE PR SAMPLE THICKNES SELECTED DATA I	LIMIT .04 ppm  RMEATION RATE 10.04 S: 19-20 mils	III) (Lg/cm²*hr)	
•	•			
	TLE	: CONCENTRATION	: CONCENTRATION :	CONCENTRATION
	1.	<u>:</u>	<u>:</u> :	
	2		: :	
	3.	:	<u>:</u> :	
	4.	<u>:</u>	:	
	5.		:	
	6.	:		
	7.	<u> </u>	<u>:</u>	
	8. 9.	· · · · · · · · · · · · · · · · · · ·		
		•		
	10.	<u> </u>	<u>.</u>	
8.	OTHER OBSERVATO	ONS:		
5. SC	URCE OF DATA			
		run by Denise McDon-18	on February 24, 1987.	
		J. Juliage Mesonale	O. FEDILIARY 24, 198/.	

Chemical Resistance Testing of Creased 5100 Carbon Disuffide Run'III



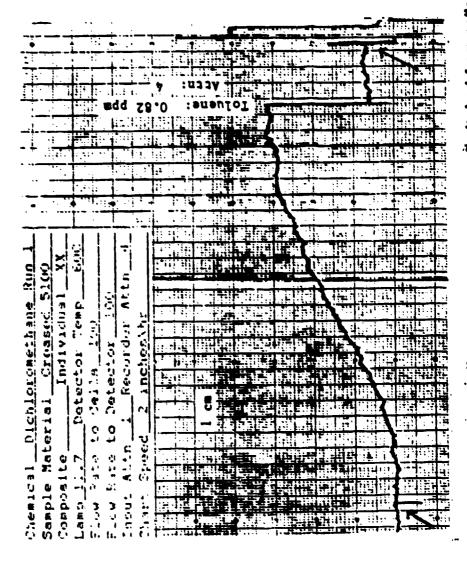
Composite

Carbon Disuffide charged into cell Switched from cells to standard gas

	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068		*
	3: CONDITION BEFORE TEST: Unused, no	visible imperfections	<del></del>
	4: MANUFACTURER: Chemfab Corp.		
	5: PRODUCT IDENTIFICATION: Challenge	5100	
	6: LOT OR MANUFACTURER DATE: N/A		
	7: NOMINAL THICKNESS: 15-20 mil		
	8: DESCRIPTION: Material was orange c		
	other side. Sample was creased usi	ng CHEMFAB Fold Resista	nce Test procedu
	of 5 September 1986.		
2.	TEST METHOD		
	1. TESTING LABORATORY: Texas Research		
	2. ANALYTICAL METHOD: Continuous phot	olonization detection w	ith a 11./0 eV 1
	3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: No	<del></del>	<del></del>
	4. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION SYSTEM: N <sub>2</sub>		<del></del>
	6. OTHER CONDITIONS: 1 inch cell was	ward /Datastan Tamasan	- 600
	7. DEVIATIONS FROM ASTM F739 METHOD:	Flow rate to cell was 1	00 cc/min.
<b>3</b> .	CHALLENGE CHEMICAL 1	: COMPONENT 2 :	3
	1. CHEM NAME(s): Dichloromethane	: : N/A :	N/A
	2. CAS NUMBER(*): 75-09-2	: N/A :	
	3. CONC. (IF MIX) N/A	: N/A :	N/A
	4. CHEMICAL SOURCE: Fisher	. N/A :	N/A
	1. DATE TESTED: 4-13-87 2. NUMBER OF SAMPLES TESTED: One (Run 3. BREAKTHROUGH TIME: 53 minutes	1)	
	4. MIN DETECTABLE LIMIT .71 ppm		
	5. STEADY STATE PERMEATION RATE 3.79	(ug/cm2*hr)	
	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils	(ug/cm2*hr)	
	5. STEADY STATE PERMEATION RATE 3.79	(ug/cm2*hr)	
	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils		CONCENTRATION
	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS N/A		CONCENTRATION
	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS N/A		CONCENTRATION
	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS N/A		CONCENTRATION
	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : 2. : 3. :		CONCENTRATION
	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : 2. : 3. : 4. :		CONCENTRATION
	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. :		CONCENTRATION
	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :		CONCENTRATION
	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :		CONCENTRATION
	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :		CONCENTRATION
	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :		CONCENTRATION
•	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :		© NCENTRATION
5.	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION
5.	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :  8. OTHER OBSERVATIONS:	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION
5.	5. STEADY STATE PERMEATION RATE 3.79 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :  8. OTHER OBSERVATIONS:	: CONCENTRATION : : : : : : : : : : : : : : : : : : :	CONCENTRATION

# Chemical Resistance Testing of Craased 5100

### Dichloromethane Run I



Secretary Secretary

DE :	SCRIPTION OF PRO	DDUCT EVALUATED		•	
1:		laminated Nomex			
2:		TERIAL CODE: 068			
3:		ORE TEST: Unused, no	visible imperfection	ns	
4:		Chemfab Corp.			
5:	PRODUCT IDENT	IFICATION: Challenge	3100		
6:		CTURER DATE: N/A			
7:		VESS: 15-20 mil			
8:		Material was orange co			
	of 5 September 5	Sample was creased usiner 1986.	ng CHEMFAB Fold Rei	ilstan	ce Test procedur
TE:	ST METHOD				
1.	TESTING LABOR	ATORY: Texas Research	Institute, 9063 Bea	e Cave	s Road, Austin,
2.		THOD: Continuous photo			
3.	TEMPERATURE:	22-25°C			
4.	= -				
5.					
6.	OTHER CONDITIO	MS: linch cell was	used. /Detector Tel	perat	ure = 60C.
7.	DEVIATIONS FRO	M ASIM F739 METHOD:	flow rate to cell a	7as 10	0 cc/min.
CH	allence chemical	1	; COMPONENT 2	:	3
1.	CHEM NAME (e)	Dichloromethane	: : N/A	•	N/A
	CAS NUMBER(s)		N/A	:-	N/A
	CONC. (IF MIX		N/A	:-	N/A
4.	•		: N/A	:-	N/A
2. 3. 4. 5.	BREAKTHROUGH TO MIN DETECTABLE STEADY STATE PI	LES TESTED: One (Run IME: 58 minutes LIMIT .79 ppm ERMEATION RATE 3.08	II) (ug/cm2*hr)		
	SAMPLE THICKNES				
<b>,</b>	SELECTED DATA I	POINTS N/A			
	TIME	: CONCENTRATION	: CONCENTRATIO	: NC	CONCENTRATION
	2.		:	:	
	3.	:	•	:	
	4.	:		:	
	5.	•	:	:	
	6.			:	
	7.	:		:	
	8.	:		<del>:</del>	
	9.	:	:	:	
	10.		:	:	
•	OTUER ORCERVAT	I ONG .			
٥,	OTHER OBSERVATI	IONS:			
501	URCE OF DATA	bu Daadaa Maha	1d on Aprel 12 10:	A7.	
	Sample Was	s run by Denise McDona	TO OU WALTT 12, 12	<del>-                                    </del>	

Toluene 0.82 ppm

## Chemical Resistance Testing of Creased 5100 Dichloromethane Run II

Chemical Dichloromethene Run

Creased 5100 Recorder Attn 4 inches/hr Detector Temp [ndprarpu] Flow Rate to Detector\_ Flow Rate to Cella\_ Sample Material\_ Input Attn\_

Dichloromethane charged into cells

Switched from cells to standard gas

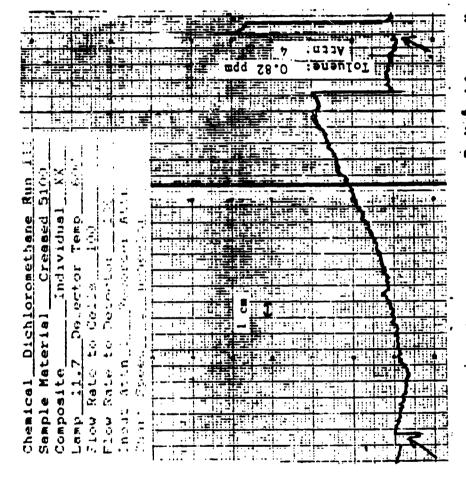
E-14

DESCRIPTION OF PRODUCT EVALUATED

1:	TYPE: Teflon	laminated Nomex		
2:		TERIAL CODE: 068		
3:		ORE TEST: Unused, no	visible imperfection	8
4:		Chemfab Corp.		
5:		IFICATION: Challenge	5100	
6:		CTURER DATE: N/A		
7:		NESS: 15-20 mil		
8:	DESCRIPTION:	Material was orange of	colored on one side a	nd buff colored on the
				stance Test procedure
	of 5 September	er 1986.		
. TE	ST METHOD			
1	TESTING LABOR	ATORY, Toron Bosonsh	T	Caves Road, Austin, TX
				n with a 11.70 eV lamp.
	TEMPERATURE:		Oldization detection	H WILH & II./O EV IMMP.
	COLLECTION ME		<del></del>	
	COLLECTION SY		<del></del>	<del></del>
		ONS: I inch cell was	used. /Detector Temp	erature = 60C.
		ON ASIN F739 METHOD:		
. CH	IALLENGE CHEMICA	L 1	: COMPONENT 2	: 3
		_	•	•
1.	CHEM NAME (s)	: Dichloromethane	: %/A	: N/A
2.	CAS NUMBER(s)	: 75-09-2	: N/A	: N/A
3.	CONC. (IT MIX	) N/A	: N/A	: N/A
4.	CHEMICAL SOUR	CE:Fisher	: N/A	: N/A
2. 3. 4. 5. 6.	MIN DETECTABLE STEADY STATE PI SAMPLE THICKNES	IME: 53 minutes  LIMIT .79 ppm  ERMEATION RATE 3.24 ( SS: 19-20 mils		
7.	SELECTED DATA	POINTS N/A		
	TIME	: CONCENTRATION	N : CONCENTRATION	: CONCENTRATION
	2.	:		
	3.	:	:	:
	4.			:
	5.	:		:
	6.	:	1	
	7.	:		
	8.		:	<u> </u>
	9	<u> </u>	:	
	10	<u>:</u>		
. 8.	OTHER OBSERVAT	IONS:		
5. <b>S</b> O	URCE OF DATA	A. D. B. J. W. N.		27
	Sample W	as run by Denise McDo	naid on April 14, 190	y , •

Chemical Resistance Testing of Creased 5100

## Dichloromethane Run III



DES	CRIPTION OF PRODUCT EVAL	LUATED		
1:	TYPE: Teflon laminated	Nomex		
2:	PROTECTIVE MATERIAL CO			
3:	CONDITION BEFORE TEST:		sible imperfections	
4:	MANUFACTURER: Chemfab			
5;	PRODUCT IDENTIFICATION		00	<del></del>
-	LOT OR MANUFACTURER DA		<del></del>	<del></del>
7:			<del></del>	
8:	DESCRIPTION: Material		ored on one side an	d buff colored on the
0.	other side. Sample was	cressed using	CHEMEAR Fold Resig	tance Test procedure
	of 5 September 1986.			
TES	T METHOD			
		_		
1.	TESTING LABORATORY: Te			
2.		ntinuous photoi	onization detection	with a 11.70 eV lamp.
	TEMPERATURE: 22-25°C			
	COLLECTION MEDIUM: N2			
	COLLECTION SYSTEM: N2			
	OTHER CONDITIONS: 1	inch cells ware	used. / Detector Te	mperature = 60C.
7.	DEVIATIONS FROM ASIM F	739 METHOD: F1	ow rate to cells wa	s 100 cc/min.
CHA	LLENGE CHEMICAL	i :	COMPONENT 2	: 3
Vn.	LIENGE CHEMICAL	•	COMPONENT 2	•
1.	CHEM NAME(s): Dieth	vlamine :	N/A	. N/A
	CAS NUMBER(s): 109-8		N/A	: N/A
	CONC. (IF MIX) N/A	<del> </del>	N/A	: N/A
	CHEMICAL SOURCE: Malli	nckrodt:	N/A	N/A
•				
TES	T RESULTS			
	DATE TESTED: 2-10-87			
	NUMBER OF SAMPLES TESTE			
	BREAKTHROUGH TIME: No		s observed after 3.	0 hours
	MIN DETECTABLE LIMIT .			
5.	STEADY STATE PERMEATION	RATE N/A		
	SAMPLE THICKNESS: 19-2			
7.	SELECTED DATA POINTS N	/A		
			00 110711771 177 011	60 NOT 1175 A T 7 A 1
	_	CONCENTRATION	: CONCENTRATION	: CONCENTRATION
	1			<u>:</u>
	2. :			:
	3		<u>:</u>	:
	4			
	5		<u>:</u>	<u>:</u>
	6:		_:	:
	7.		<u>:</u>	<u> </u>
	·			:
	9:		<u>:</u>	:
	10:		•	:
8.	OTHER OBSERVATIONS:			

Samples were run by Denise McDonald on February 10, 1987.

SOURCE OF DATA

## Chemical Resistance Testing of Creased 5100

### **Diethylamíne**

	•				7	
Chemical: Diethylamine Sample Material: Creased 5100	Composite: X Individual:	Lamp: 11.7 Detector temp: 60	Flow rate to cells: 100	Flow rate to Detector: 100	Input attn: 1 Recorder attn:	Chart speed: 2 in/hr

Toluene: 0.82 ppm strn: 8

Diethylamine charged into cells

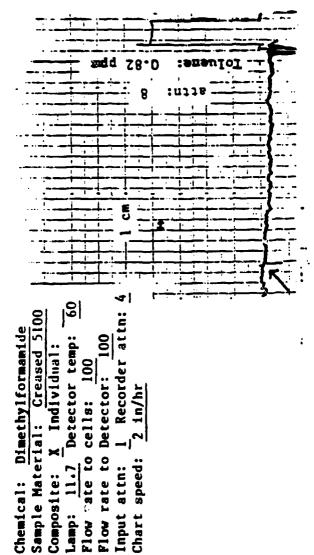
Switched from cells to standard gas

E-18

	1:	TVDG + Tafia	laminated Nomex		
	2:		TERIAL CODE: 068		
	2: 3:		ORE TEST: Unused, no v	visib's imperfections	
			Chemfab Corp.	Table appetitude	<del></del>
			IFICATION: Challenge	100	
			CTURER DATE: N/A		
	7:		ONESS: 15-20 mil		
	8:		Material was orange co		
			Sample was creased using	ng CHEMFAB Fold Resista	ince Test procedure
		of 5 Septemb	per 1986.		
	TES	T METHOD			
			LATORY: <u>Texas Research l</u>		
		ANALYTICAL ME		ionization detection w	with a 11.70 eV lamp.
		TEMPERATURE:			
		COLLECTION ME			
		OTHER CONDITI		a used / Datacran Tonn	ATTENTA = 60C
			OM ASIM F739 METHOD: F	te used. / Detector Temp	
	••	TE STATIONS IN	ton abili 1/39 agradoI	TOW TALE SO CELIB WAS	TOO CE/MIN.
•	CHA	LLENGE CHEMICA	L 1	: COMPONENT 2 :	3
			<b>.</b>	:	
		CHEM NAME (s)		:::	N/A
		CAS NUMBER(s)		: N/A :	N/A
	3. 4.	CONC. (IF MIX	K) N/A	: N/A :	N/A
	→.	CHEMICAL SOUR	CE: Mallinckrodt	: N/A :	N/A
	mr.c				
_	152	T RESULTS			
•	165	T RESULTS			
•		T RESULTS  DATE TESTED: _	2-11-87		
•	1. i	DATE TESTED: NUMBER OF SAMP	LES TESTED: Three		
•	1. 1 2. 1 3. 1	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH I	PLES TESTED: Three TIME: No breakthrough	vas observed after 4.0	hours
•	1. 1 2. 1 3. 1	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm	vas observed after 4.0	hours
•	1. 1 2. 1 3. 1 4. 1 5.	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH I MIN DETECTABLE STEADY STATE F	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A	vas observed after 4.0	hours
•	1. 1 2. 1 3. 4. 1 5. 6. 1	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE	PLES TESTED: Three TIME: No breakthrough w LIMIT .40 ppm PERMEATION RATE N/A LSS: 19-20 mil	was observed after 4.0	hours
•	1. 1 2. 1 3. 4. 1 5. 6. 1	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH I MIN DETECTABLE STEADY STATE F	PLES TESTED: Three TIME: No breakthrough w LIMIT .40 ppm PERMEATION RATE N/A LSS: 19-20 mil	was observed after 4.0	hours
•	1. 1 2. 1 3. 4. 1 5. 6. 1	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE	PLES TESTED: Three TIME: No breakthrough w LIMIT .40 ppm PERMEATION RATE N/A LSS: 19-20 mil		
•	1. 1 2. 1 3. 4. 1 5. 6. 1	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH I MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA TIME	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A LSS: 19-20 mil POINTS N/A		
•	1. 1 2. 1 3. 4. 1 5. 6. 1 7.	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH I MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME 1.	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A LSS: 19-20 mil POINTS N/A		
•	1. 1 2. 1 3. 4. 1 5. 6. 1 7.	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH I MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA TIME	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A LSS: 19-20 mil POINTS N/A		
•	1. 1 2. 1 3. 4. 1 5. 6. 1 7.	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH I MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME 1.	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A LSS: 19-20 mil POINTS N/A		
•	1. 1 2. 1 3. 1 4. 1 5. 6. 1	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME 1. 2. 3.	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A LSS: 19-20 mil POINTS N/A		
•	1. 1 2. 1 3. 1 4. 1 5. 6. 1	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH I MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME 1.	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A LSS: 19-20 mil POINTS N/A		
•	1. 1 2. 1 3. 4. 1 5. 6. 1 7.	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6.	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A LSS: 19-20 mil POINTS N/A		
•	1. 1 2. 1 3. 4. 1 5. 6. 1 7. 1	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME 1. 2. 3. 4. 5. 6. 7.	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A LSS: 19-20 mil POINTS N/A		
•	1. 1 2. 1 3. 4. 5 6. 7	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8.	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A LSS: 19-20 mil POINTS N/A		
•	1. 1 2. 1 3. 4. 5 6. 7	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME 1. 2. 3. 4. 5. 6. 7.	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A LSS: 19-20 mil POINTS N/A		
•	1. 1 2. 1 3. 4. 1 5. 6. 7	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8.	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A CSS: 19-20 mil POINTS N/A  : CONCENTRATION : : : : : : : : : : :		
•	1. 1 2. 1 3. 4. 1 5. 6. 7	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A CSS: 19-20 mil POINTS N/A  : CONCENTRATION : : : : : : : : : : :		
	1. 1 2. 1 3. 4. 5 6. 7.	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A CSS: 19-20 mil POINTS N/A  : CONCENTRATION : : : : : : : : : : :		
	1. 1 2. 1 3. 4. 5 6. 7.	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9. 10. OTHER OBSERVAT	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A LSS: 19-20 mil POINTS N/A  : CONCENTRATION : : : : : : : : : : : : : : : : : : :	: CONCENTRATION : : : : :	CONCENTRATION
	1. 1 2. 1 3. 4. 5 6. 7.	DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9. 10. OTHER OBSERVAT	PLES TESTED: Three TIME: No breakthrough v LIMIT .40 ppm PERMEATION RATE N/A CSS: 19-20 mil POINTS N/A  : CONCENTRATION : : : : : : : : : : :	: CONCENTRATION : : : : :	CONCENTRATION

## Chemical Resistance Testing of Creased 5100

### Dimethylformamide



Dimethylformemide charged into cells

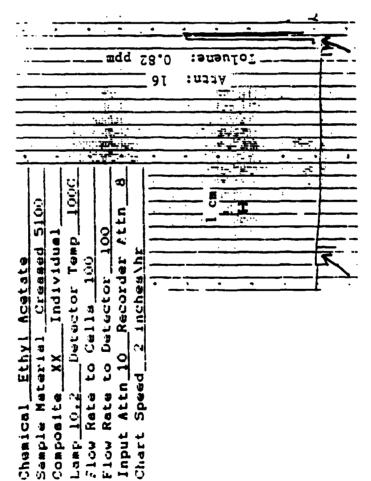
Switched from cells to standard gas

DE	SCRIFTION OF	PRODUCT EV	AL UATED				
1:	TYPE: Tefl						·
2:		MATERIAL CO					
_			: Unused, no	visible	imperfection	ns	·
	MANUFACTUR						
_			N: Challenge	5100			
6:		UFACTURER DA					
	NOMINAL TH						
8:							colored on the
		enber 1986.	is creased us	ing CHES	rab rold kes	istance	Test procedure
ΤE	ST METHOD						
	- 	DOBATORY. T		. T1-	0063 n	<b></b> "	)
1.							Road, Austin, The a 10.20 eV lam
	TEMPERATUR		ontinuous pho	COLONIZA	tion detecti	on with	a 10.20 ev 12m
				<del></del>	· · · · · · · · · · · · · · · · · · ·		
<b>4.</b>							
	COLLECTION				/D	T	1000
6.			inch cells v				
•	ue (ial-uini	raum Abin i	ניוחא אדיאוחה:	I TOM IN	TE TO COLIS	MEE INO	CC/BIN•
СН	ALLENGE CHEN	fical.	1	: C0	MPONENT 2	:	3
1.	CHEM NAME (	(s): Ethvl	Acetate	:	N/A	:	N/A
	CAS NUMBER				N/A		N/A
	CONC. (IF			:	N/A	:	N/A
	CHEMICAL S		ience	:	N/A	:	N/A
1. 2. 3.	DATE TESTEINUMBER OF SEREAKTHROUGHIN DETECTA	SAMPLES TEST OH TIME: N/A NBLE LIMIT	.20 ppm				
٥.	STEADY STAT	E PERMEATIO	N RATE N/A	<del></del>	<del></del>		
	SAMPLE THIC SELECTED DA				<del></del>		
′•	SELECIED DE	in Polals	N/A				
	TIME	<b>;</b>	CONCENTRATIO	: NO	CONCENTRATIO	: KC	CONCENTRATION
	1. 2.	<u> </u>		<del>:</del>	<del></del>	<del>:</del>	
	3.	<del></del>		<del></del>		<u></u>	
	4.	<u> </u>		<u>`</u> _		<u>-</u>	
	5.	<u> </u>	<del></del>	<u>`</u>		<del></del> ;	
	6.	:		<u></u>		:	
		<u> </u>		<u> </u>		:	
	8.	<del></del>		<u>-</u> -	<del></del>	<del></del>	
	9.	:		:		<u>·</u>	
		<del></del>		<del></del> :		<del>:</del> -	
	10.						
	10						
8.	OTHER OBSER	RVATIONS:					

Samples were run by Denise McDonald on March 4, 1987.

# Chemical Resistance Testing of Creased 5100

### Ethyl Acetate



Ethyl Acetate charged into cells SwitchOd from cells to standard gas

	1: 2:	المراج ا								
	3:	_			visible imperfection	ns				
	4:	MANUFACTURER	: Chemf	ab Corp.						
	5:			ON: Challenge	5100					
	6:	LOT OR MANUF								
	7:	NOMINAL THIC								
	8:	DESCRIPTION:	Materi	al was orange	colored on one side	and buil o	olored on the			
		of 5 Septem			ing CHEMFAB Fold Res	istance le	st procedure			
		OI 2 SESCER	DE1 1300	' •						
•	TES	T METHOD								
	•	##9#***** 1480 -	.veuz74	Taves Deservat	Institute, 9063 Bee	Cause Ros	d Augets TY			
	2.	ANALYTICAL M			toionization detecti					
	3.	TEMPERATURE:			COLUMN GELECTI		10110 01 1000			
	4.	COLLECTION M		No						
	3.	COLLECTION 5	_	N <sub>2</sub>						
	ó.	STHER CONDIT	CIONS:	l inch cells w	ere used./Detector I					
	7.	DEVILLIONS F	304 72 <u>21</u>	F739 METHOD:	Flow rate to cells	was 100 co	/min.			
•	CHA	LIENGE CHEMIC	AL	1	: COMPONENT 2	:	3			
					•	:				
		CHEM NAME(s)			: N/A	:	N/A			
		CAS NUMBER(s		•54-3	: <u>N/A</u>	;	N/A			
		CONC. (IF MI		<del></del>	: N/A		N/A			
	4.	CHEMICAL SOU	RCE: Aldr	rich	:N/A	:	N/A			
	TES	T RESULTS								
•										
	1.	DATE TESTED:	3-3-87							
	2.	NUMBER OF SAM	PLES TES	TED: Three						
		BREAKTHROUGH								
		MIN DETECTABL	PERMEATI							
	5.	STEADY STATE								
	5. 6.	STEADY STATE SAMPLE THICKN	ÆSS: 19	32 / 4						
	5. 6.	STEADY STATE	ÆSS: 19	N/A						
	5. 6.	STEADY STATE SAMPLE THICKN SELECTED DATA	ÆSS: 19		N : CONCENTRATIO	ON : CO1	WCENTRATION			
	5. 6. 7.	STEADY STATE SAMPLE THICKN SELECTED DATA TIME	ÆSS: 19	N/A CONCENTRATIO	N : CONCENTRATIO	ON : CO!	NCENTRATION			
	5. 6. 7.	STEADY STATE SAMPLE THICKN SELECTED DATA TIME	ÆSS: 19		N : CONCENTRATIO	ON : CO1	NCENTRATION			
	5. 6. 7.	STEADY STATE SAMPLE THICKN SELECTED DATA TIME	ÆSS: 19		N : CONCENTRATIO	ON : COI	NCENTRATION			
	5. 6. 7.	STEADY STATE SAMPLE THICKN SELECTED DATA  TIME 1. 2.	ÆSS: 19		N : CONCENTRATIO	ON : COI	WCENTRATION			
	5. 6. 7.	STEADY STATE SAMPLE THICKN SELECTED DATA TIME	ÆSS: 19		N : CONCENTRATIO	ON : COI	NCENTRATION			
	5. 6. 7.	STEADY STATE SAMPLE THICKN SELECTED DATA  TIME 1. 2.	ÆSS: 19		N : CONCENTRATIO	ON : COI	NCENTRATION			
	5. 6. 7.	STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7.	ÆSS: 19		N : CO NCE NTRATIO	ON : COI	WCENTRATION			
	5. 6. 7.	STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7.	ÆSS: 19		N : CO NCE NTRAT I (	ON : CON : : : : : : : : : : : : : : : : : : :	WCENTRATION			
	5. 6. 7.	STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8.	ÆSS: 19		N : CO NCE NTRAT I (	ON : COI	WCENTRATION			
	5. 6. 7.	STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7.	ÆSS: 19		N : CONCENTRATIO	ON : COI	VCENTRATION			
	5. 6. 7.	STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	TESS: 19 A POINTS : : : : : : : : : : : : : : : : : : :		ON : CONCENTRATIO	ON : CON	WCENTRATION			
	5. 6. 7.	STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8.	TESS: 19 A POINTS : : : : : : : : : : : : : : : : : : :		ON : CONCENTRATIO	ON : CON : : : : : : : : : : : : : : : : : : :	WCENTRATION			
	5. 6. 7.	STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	TESS: 19 A POINTS : : : : : : : : : : : : : : : : : : :		CONCENTRATIO	ON : COI	WENTRATION			
•	5. 6. 7.	STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	TESS: 19 A POINTS : : : : : : : : : : : : : : : : : : :		N : CONCENTRATIO	ON : CON : : : : : : : : : : : : : : : : : : :				
•	5. 6. 7.	STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9. 10. OTHER OBSERVA	TESS: 19 A POINTS : : : : : : : : : : : : : : : : : : :	CONCENTRATIO	CONCENTRATIO	:	WENTRATION F			

# Chemical Resistance Testing of Creased 5100

Hexane

Chemical Hexene Sample Material

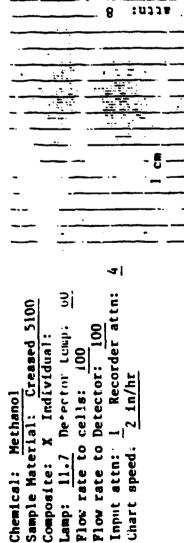
Switched from cells to standard gas Hexans charged into cells

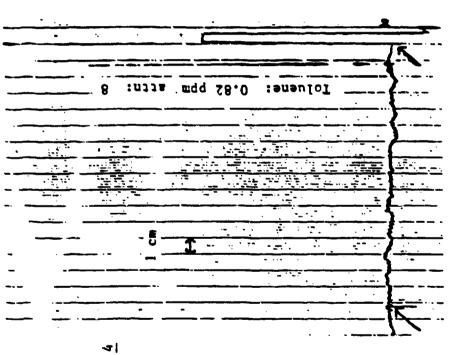
1:						
2:						
3:	CONDITION B	EFORE TE	ST: Unused, no v	isible imperfe	ctions	
4:						
5:			ICN: Challenge 5	100		
-	LOT OR MANU					
7:						
8:			ial was orange co			
	of 5 Septer		was creased usin	A CUTWLYP LOIG	Kesistance	lest procedure
	OI J DEPLE	mber 130			<del></del>	
TE	ST METHOD					
1.			Texas Research I			
	ANALYTICAL	_		<u>ionization det</u>	ection with	a 11.70 eV lat
3.						
4				<del></del>		
	COLLECTION :		N <sub>2</sub> 1 inch cells wer	a ward / Datas	ton Tonnani	- 60C
7-	DEVIATIONS	ESUM YELL TTOUS:	1 1nch cells were 739 METHOD: F	low tate to se	lor remperat	cc/min.
						/ CL. 4
CH	ALLENGE CHEMI	CAL	1	: COMPONENT	2 :	3
1.	CHEM NAME (s	) : Me	thanol	: N/A	•	N/A
	CAS NUMBER	s): <u>81</u>	1-98-3	N/A		N/A
3.	CONC. (IF M	$IX)$ $\overline{N}/$	A	N/A		N/A
4.	CHEMICAL SO	URCE: Fi	sher	: N/A		N/A
	ST RESULTS	•				
_	DATE TESTED:					
	NUMBER OF SAI				2 2 2	
J.	MIN DETECTAB	TTWE:	No breakthrough w	as observed ar	ter 3.2 nous	5 •
5.	STEADY STATE	DERMEAT!	ION RATE N/A			
	SAMPLE THICK					<del></del>
	SELECTED DATA					
	TIME	:	CONCENTRATION	: CONCENTR	ATION : (	CONCENTRATION
	1	<del></del>			<u> </u>	
	3.	<del></del> _			<del></del>	<del></del>
	4.	<del></del>		•	<del></del>	
	5.	<del></del>		<del>·</del>	<del></del>	
	6.	<del></del>		<del></del>		. <del></del>
	7.	<u>-</u>		:	<u>-</u>	
	8.	<del></del>		:	:	
	9.	:	——————————————————————————————————————	:	:	
	10.	<del></del> -	· <del></del>	:	:	<del> · - · </del>
	- • •					

Samples were run by Denise McDonald on February 4, 1987.

# Chemical Resistance Testing of Credised 5100

### Methanol





Methanol charged into cells

Switched from cells to standard gas

1.	DESCRIPTION OF PRODUCT EVALUATED		
	1: TYPE: Teflon laminated Nomex 2: PROTECTIVE MATERIAL CODE: 068		
	3: CONDITION BEFORE TEST: Unused, no	visible imperfections	
	4: MANUFACTURER: Chemfab Corp.		
	5: PRODUCT IDENTIFICATION: Challenge	5100	_ <del></del>
	6: LOT CR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil		
	· · · · · · · · · · · · · · · · · · ·	colored on one side and	buff colored on the
	other side. Sample was creased us		
	of 5 September 1986.		
2.	TEST METHOD		
	1. TESTING LABORATORY: Texas Research	Institute, 9063 Bee Ca	ves Road. Austin. TX
	2. ANALYTICAL METHOD: Continuous pho		
	3. TEMPERATURE: 22-25°C		
	4. COLLECTION MEDIUM: No		
	5. COLLECTION SYSTEM: No		
	6. OTHER CONDITIONS: 1 inch cells w		
	7. DEVIATIONS FROM ASIM F739 METHOD:	Flow late to cells was	100 ec/min.
3.	CHALLENGE CHEMICAL 1	: COMPONENT 2	3 :
	1. CHEM NAME(s): Nitrobenzene	: N/A	N/A
	2. CAS NUMBER(s): 98-95-3	: N/A	N/A
	3. CONC. (IF MIX) N/A	: N/A	N/A
	4. CHEMICAL SOURCE: Mallinckrodt	:N/A	:N/A
4.	TEST RESULTS		
	1. DATE TESTED: 2-26-87		
	2. NUMBER OF SAMPLES TESTED: Three		
	3. BREAKTHROUGH TIME: N/A 4. MIN DETECTABLE LIMIT .06		
	5. STEADY STATE PERMEATION RATE N/A		
	6. SAMPLE THICKNESS: 19-20 mils		
	7. SELECTED DATA POINTS N/A		
	TIME : CONCENTRATIO	N : CONCENTRATION	: CONCENTRATION
	2.	•	•
	3.	:	·
	4.		:
	5	<u>:</u>	
	6	<u> </u>	:
	7. :	:	:
	8. :	<u> </u>	:
	9. : 10. :	<del></del>	<u> </u>
	•••	<u> </u>	•
	8. OTHER OBSERVATIONS:		
5.	SOURCE OF DATA		

Samples were run by Denise McDonald on February 26, 1987.

Chemical Resistance Testing of Creased 5100

Nitrobenzene

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Creased Individual ctor Te	C C C C C C C C C C C C C C C C C C C									
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200377	i i i		.!				<u>!</u>		<u> </u>	K

Nitrobenzene charged into cell

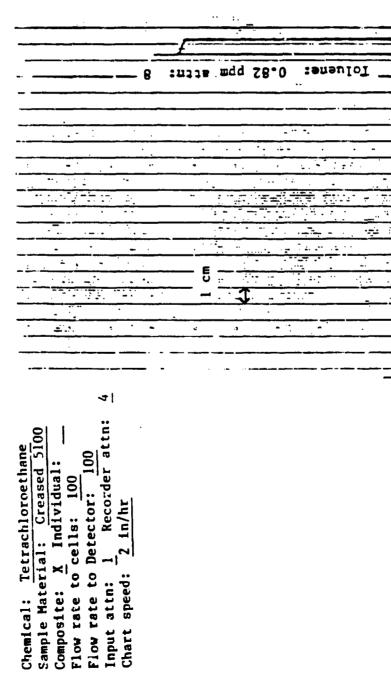
Switched from cells to standard gas

2:	TYPE: Teflon law PROTECTIVE MATER				
3:	CONDITION BEFORE	TEST: Unused, no vis	ible imperfection	ne	
4:	MANUFACTURER:C	hemfab Corp.			
5:		CATION: Challenge 510	0		
6:	• - • • • •				
7:					
8:		terial was orange colo			
	of 5 September	ple was creased using 1986.	THEMIND FOLD KES	istance.	est procedur
TE:	ST METHOD				
1.	TESTING LABORATO	RY: Texas Research Ins	titute, 9063 Bee	Caves Re	oad, Austin,
2.	ANALYTICAL METHO	D: Continuous photoio	nization detecti	on with	11.70 eV la
3.					
4.	_ <del>_</del>				
5.					
	OTHER CONDITIONS	: linch cells were	used. / Detector	Temperati	re = 60C.
7.	DEVIATIONS FROM	ASIM F739 METHOD: Flo	w rate to cells	WES 100	cc/min.
CH	ALLENGE CHEMICAL	1 :	COMPONENT 2	:	3
1.	CHEM NAME(s):	Tetrachloroethane:	TI/A	:	N/A
2.		79-34-5 :	N/A		N/A
3.		N/A :	N/A	;	N/A
4.	CHEMICAL SOURCE:	Aldrich :	N/A		N/A
	DATE TESTED: 2-0	TESTED: Three	channed often	3.2 hours	
3. 4. 5. 6.	NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS:	MIT .07 ppm EATION RATE N/A 19-20 mil	observed after		
3. 4. 5. 6.	BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI	MIT .07 ppm EATION RATE N/A 19-20 mil	observed after		
3. 4. 5. 6.	BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS:	MIT .07 ppm EATION RATE N/A 19-20 mil NTS N/A	: CONCENTRATIO	ON : CO	ONCENTRATION
3. 4. 5. 6.	BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1. :	MIT .07 ppm EATION RATE N/A 19-20 mil NTS N/A		ON : CO	ONCENTRATION
3. 4. 5. 6.	BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1. : 2. : 3. :	MIT .07 ppm EATION RATE N/A 19-20 mil NTS N/A		ON : CO	ONCENTRATION
3. 4. 5. 6.	BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1. :: 2. :: 3. :: 4. ::	MIT .07 ppm EATION RATE N/A 19-20 mil NTS N/A		ON : CO	ONCENTRATION
3. 4. 5. 6.	BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1. : 2. : 3. : 4. : 5. :	MIT .07 ppm EATION RATE N/A 19-20 mil NTS N/A		ON : CO	ONCENTRATION
3. 4. 5. 6.	BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1. :: 2. :: 3. :: 4. :: 5. :: 6. ::	MIT .07 ppm EATION RATE N/A 19-20 mil NTS N/A		ON : CO	ONCENTRATION
3. 4. 5. 6.	BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1. :: 2. :: 3. :: 4. :: 5. :: 6. :: 7. ::	MIT .07 ppm EATION RATE N/A 19-20 mil NTS N/A	: CONCENTRATIO	:	) NCE NTRATION
3. 4. 5. 6.	BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1. :: 2. :: 3. :: 4. :: 5. :: 6. :: 7. :: 8. ::	MIT .07 ppm EATION RATE N/A 19-20 mil NTS N/A		ON : CO	ONCENTRATION
3. 4. 5. 6.	BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME:  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	MIT .07 ppm EATION RATE N/A 19-20 mil NTS N/A	: CONCENTRATIO	:	ONCENTRATION
3. 4. 5. 6.	BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1. :: 2. :: 3. :: 4. :: 5. :: 6. :: 7. :: 8. ::	MIT .07 ppm EATION RATE N/A 19-20 mil NTS N/A	: CONCENTRATIO	:	ONCENTRATION
3. 4. 5. 6. 7.	BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME:  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	MIT .07 ppm EATION RATE N/A 19-20 mil NTS N/A  CONCENTRATION	: CONCENTRATIO	:	ONCENTRATION

# Chemical Resistance Testing of Creased 5100

1.089.4

### Tetrachloroethane



Tetrachloroethane charged into cells

Switched from cells to standard gas

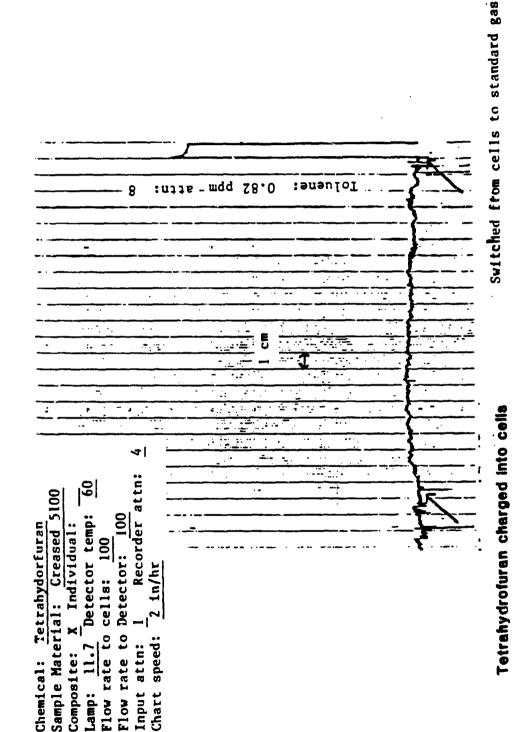
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1:					· · · · · · · · · · · · · · · · · · ·				
2:									
3:									
4:									
5:		ATION: Challenge	5100		·····				
6:									
7:									
8:		erial was orange c							
	of 5 September 1	le was creased usi:	ng CHEMFAB FOLD Ke	sistance	Test procedure				
TE	ST METHOD								
1.	TESTING LAROPATOR	Y: Texas Research	Toetituta 9063 Ra	o Ceves P	ond Austin T				
2.		: Continuous phot							
3.			Olonibation detect	2011 -2011					
4.	<del></del>			<del></del>	·				
	COLLECTION SYSTEM								
	OTHER CONDITIONS:		re used. / Detector	Temperat	nte '= 60C.				
7.		STM F739 METHOD:	Flow rate to cells	was 100	cc/min-				
CH	ALIENCE CHEMICAL	1	: COMPONENT 2	:	3				
1	CHEM NAME (s) :	Tet rahydrofuran	: : N/A	:	N/A				
		109-99-9	N/A	:	N/A				
		N/A .	N/A	:	N/A				
4.	· · · · · · · · · · · · · · · · · · ·		N/A N/A	:	N/A				
TE:	ST RESULTS	•							
- •	DATE TESTED: 2-05	<del></del>							
	NUMBER OF SAMPLES								
	BREAKTHROUGH TIME:		was observed after	3.9 hour	<u>s.</u>				
	MIN DETECTABLE LIM								
-	STEADY STATE PERME				<del></del>				
	SAMPLE THICKNESS: SELECTED DATA POIN				<del> </del>				
		CONCENTRATION	• CONCENTRATI	ON . C	ONCE NTD ATTON				
	1 :	CONCENTRALION	: CONCENTRATI	.ON : U	ONCENTRATION				
	2. :			:					
	3. :			:					
	4:		:	:					
	5. :		:	:					
	6:	<del></del>	:	•					
	7. :		<u> </u>	<u>:</u>					
			:	<u> </u>	<del></del>				
	8. :			<u> </u>	<del></del>				
	9. :	<del></del>							
			:	<del></del> -					
8.	9. :	:	:	<b>:</b>					
8.	9. :	:	•	:					

# Chemical Resistance Testing of Creased 5100

### Tetrahydrofuran



11111

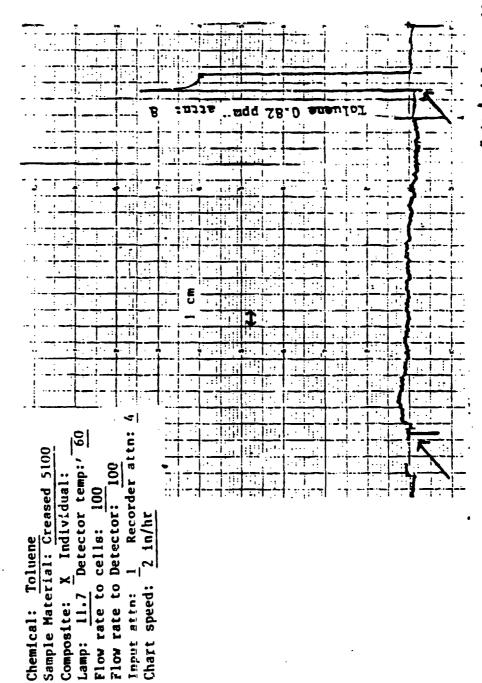
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				•
		<del></del>	<del></del>	
3: CONDITION BEFORE	TEST: Unused, no	visible im	perfections	
4: MANUFACTURER: C	hemfab Corp.			
		5100		
or bescription: Ma	cerial was orange	colored on (	one side and b	uff colored on the
of 5 September	1986.	ing Charles	FOIN RESISTAN	ce lest procedure
TEST METHOD				
1. TESTING LABORATOR	RY: Texas Research	Institute.	9063 Bee Cave	s Road. Austin. TX
2. ANALYTICAL METHO	D: Continuous pho	toionization	detection wi	th a 11.70 eV lamp.
3. TEMPERATURE: 22-	25 °C			
<del>-</del>				
		ere used./ I	etector Tempe	rature = 60C.
7. DEVIATIONS FROM	ASIM F739 METHOD:	Flow rate t	o cells was I	00 cc/min.
CHALLENGE CHEMICAL	1	: COMPON	ENT 2:	3
4 desert strangers	• •	;	•	
	101uene			N/A
_				N/A
				N/A N/A
1. DATE TESTED: 2-09				
3. BREAKTHROUGH TIME:	No breakthrough	was observe	d after 3.8 h	ours
4. MIN DETECTABLE LIN	IIT .02 ppm			
<u> </u>				
/. SELECTED DATA POIN	NTS N/A	<del></del>		
TIME :	CONCENTRATIO	N : CONC	ENTRATION :	CONCENTRATION
2:		•	<u> </u>	
3:		:	:	
4.		:	•	<del></del>
		:	:	
			:	
		:	:	
			•	
			:	
10:		<u> </u>		
B. OTHER OBSERVATIONS	5:	<del></del>		
<del></del>				
SOURCE OF DATA				
	2: PROTECTIVE MATER 3: CONDITION BEFORE 4: MANUFACTURER:C 5: PRODUCT IDENTIFI 6: LOT OR MANUFACTU 7: NOMINAL THICKNES 8: DESCRIPTION: Ma	4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIPTION: Material was orange other side. Sample was creased us of 5 September 1986.  TEST METHOD  1. TESTING LABORATORY: Texas Research Continuous phose of 5 September 1986.  TEST METHOD  1. TESTING LABORATORY: Texas Research Continuous phose of 5 September 1986.  TEMPERATURE: 22-25 °C  4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cells were not continuous phose of the conditions of the cells were not continuous phose of the conditions of the cells were not continuous phose of the cells were not continuous phose of the cells were not continuous phose of the cells were not cells were not continuous phose of the cells were not cells were	2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible im; 4: MANUFACTURER: Chemfab	2: PROTECTIVE MATERIAL CODE: 068 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Challenge 5100 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 15-20 mil 8: DESCRIFTION: Material was orange colored on one side and be other side. Sample was creased using CHEMFAB Fold Resistant of 5 September 1986.  TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Cave 2. ANALYTICAL METHOD: Continuous photoionization detection wide. Temperature: 22-25 °C 4. COLLECTION MEDIUM: No. Continuous photoionization detection wide. Temperature: 22-25 °C 4. COLLECTION MEDIUM: No. Continuous photoionization detection wide. Temperature: 21-20 °C 6. OTHER CONDITIONS: 1 inch cells were used. / Detector Temperature: 22-25 °C 7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells was I CHALLENGE CHEMICAL 1: COMPORENT 2: 1 1. CHEM NAME(s): Toluene N/A: 1 2. CAS NUMBER(s): 108-88-3 N/A: N/A: 1 3. CONC. (IF MIX) N/A: N/A: N/A: 1 4. CHEMICAL SOURCE: Mallinckrodt: N/A: N/A: 1 4. CHEMICAL SOURCE: Mallinckrodt: N/A: 1 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 19-20 mil 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: 1 2. : : : : : : : : : : : : : : : : : : :

# Chemical Resistance Testing of Creased 5100

### Toluene

Composite:



Toluene charged into cells

Switched from cells to standard gas

### APPENDIX F

### PERMEATION TEST DATA FOR VISOR MATERIAL SAMPLES

(Data Provided by Texas Research Institute Under Contract)

1.	DES	CRIPTION OF PRO	DUCT EVALUATED				
	1:	TYPE: Teflon					
	2:	PROTECTIVE MAT	TERIAL CODE: 09				
	3:	CONDITION BEFO	RE TEST: Unused,	no visible :	<b>Imperfecti</b>	ons	
	4:	MANUFACTURER:	Dupont				
	5:	PRODUCT IDENT	IFICATION: Visor				
	6:	LOT OR MANUFAC	TURER DATE: N/A				
			WESS: 11-13 mils				
	8:	DESCRIPTION:	Material was a whi	te transpar	ent sheet.		
2.	TES	ST METHOD					
	1.	TESTING LABORA	ATORY: Texas Resear	ch Institut	e. 9063 Be	e Caves Ro	ad, Austin, TX
	2.	ANALYTICAL MET	THOD: Continuous p	hotoionizat	ion detect	ion with	10.20 eV amp.
	3.	TEMPERATURE:	22-25°C				
		COLLECTION MET					
	5.	COLLECTION SYS	STEM: N2				
	6.	OTHER CONDITIO	ONS: 1 inch cells	were used.	Detector	Temperatur	e= 100C.
	7.	DEVIATIONS FRO	OM ASTM F739 METHOD	: Flow rate	to cells	were 100 c	c/min.
3.	CHA	LLENGE CHEMICAL	L 1	: COM	PONENT 2	:	3
				:	_	:	
		CHEM NAME(s)		<u> </u>	N/A	:	N/A
		CAS NUMBER(s)		:	N/A	:	N/A
		CONC. (IF HIX		:	N/A	:	N/A
	4.	CHEMICAL SOUR	CE:Mallinckrodt	:	N/A	i	N/A
4.	1. 2. 3. 4. 5.	BREAKTHROUGH TO	LES TESTED: Three IME: No breakthrou LIMIT .07 ppm ERMEATION RATE N/ SS: 12 mils	gh was obse	rved after	3.25 hour	***
		TIME	: CONCENTRAT	: C	ONCENTRAT	ton : C	NCENTRATION
		2.	<u>:</u>	<u> </u>		<u> </u>	
		3.	<u> </u>	<u> </u>		:	
		4.	<u>:</u>	<u>-</u>		:	
		5.	<u></u>			<del>:</del>	
		6.				<del>:</del>	
		7.	<u> </u>			<u>-</u>	
		8		<u>-</u>		<del></del>	
		9.	<u>:</u>				
		10		<u> </u>	<del></del>		
	8.	OTHER OBSERVAT	IONS:				
•							
5.	sot	URCE OF DATA				1007	
		Samples w	ere run by Denise l	schonald on	April b,	175/.	

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# Chemical Resistance Testing of Visor Material

### Acetone

		•	THE PROPERTY OF THE PARTY OF TH			Toluene: 0.82 ppm		A COLUMN TO THE PROPERTY OF TH	
Chemical Acetone	Sample Material Visor	Conposite XX Individual	Lamp 10.2 December Tone 1000	Tion Rate to Calls 100	Flow Rate to Detector 100	Input Attn 10 Recorder Attn 3	Chart Speed 10 inches/hr		

Acetone charged into cells

Switched from cells to standard gas

F-a

DESCRIPTION OF PRODUCT EVALUATED

4: 1 5: 5 6: 5 7: 1 8: 5 TEST	M INUFACTURER: PRODUCT IDENT LOT OR MANUFA NOMINAL THICK DESCRIPTION: METHOD TESTING LABOR ANALYTICAL ME	Dupo TIFICAT ACTURER CNESS: Mater	ION: Visor DATE: N/A				
5:	PRODUCT IDENT LOT OR MANUFA NOMINAL THICK DESCRIPTION:  METHOD TESTING LABOR ANALYTICAL ME	TIFICAT ACTURER CNESS: Mater	ION: Visor DATE: N/A 11-13 mil	trans	parent sheet.		
5: 1 7: 1 8: 1 TEST	LOT OR MANUFA NOMINAL THICK DESCRIPTION:  METHOD TESTING LABOR ANALYTICAL ME	ACTURER CNESS: Mater	DATE: N/A 11-13 mil	trans	parent sheet.		
7: 1 8: : TEST 1. :	NOMINAL THICK DESCRIPTION:  METHOD  TESTING LABOR ANALYTICAL ME	NESS: Mater	11-13 mil	trens	parent sheet.		
8: : : TEST  1. : : : : : : : : : : : : : : : : : : :	DESCRIPTION:  METHOD  TESTING LABOR ANALYTICAL ME	Mater		trans	parent sheet.		
1. 2. 3.	METHOD TESTING LABOR ANALYTICAL ME		ial was a white	trans	parent sheet.		
1. 2. 3.	TESTING LABOR	RATORY:					
2. 3.	ANALYTICAL ME	RATORY:					
3.			Texas Research				
			Continuous pho	toioni	zation detect	ion with	a 10.20 eV la
4.	TEMPERATURE:					·	
	COLLECTION ME	EDIUM:	Nitrogen				
	COLLECTION SY						
6.	OTHER CONDITI	ions: _	l inch cells w	ere us	ed. /Detecto	or Temper	ature = 100C.
			M F739 METHOD:			was 60	cc/min.
8.	PERMEATION TE	est sys	TEM: Individua	1 Cell	Monitoring		
CHAL	LENGE CHEMICA	VT.	1	: 1	COMPONENT 2	:	3
	CHEM NAME(s)				N/A	<u> </u>	N/A
	CAS NUMBER(s)			:	N/A	:	N/A
3.	CONC. (IF MIX	$()$ $\overline{N/A}$		_:	N/A	::	N/A
4.	CHEMICAL SOUP	RCE: Ald	rich		N/A		N/A
1. D	RESULTS ATE TESTED: UMBER OF SAME					·	19
			o breakthrough	was ob	served after	3.0 hour	S.
4. M	IN DETECTABLE	LIMIT	.60 ppm				
			ION RATE N/A				
	AMPLE THICKNE					<del></del>	
7. S	ELECTED DATA	POINTS	N/A				
1	TIME	:	CONCENTRATIO	N :	CONCENTRATI	ION :	CONCENTRATION
2		<del>;</del> -		<del></del>		<del></del>	
3		<del>-:</del> -	<del></del>	2	<del></del>	<del></del> :	<del></del>
4		<del></del>	<del></del>	<del></del>		<del></del>	
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6		<del></del>		_ <del></del> -		<del></del>	
7	•	<del></del>		:		<del></del>	
8	•	<del></del>		<u>:</u>	<del></del>	<del></del>	
9	•		<del></del>				
	0.	:	<del></del>	:	<del></del>	<del></del> :	
<b>.</b> ~	TUED ABSERVE	raone -			<del></del>	<del></del>	
o. U	THER OBSERVAT	T TONS:					
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DESCRIPTION OF PRODUCT EVALUATED

**经验的** 

2:		ATERIAL CODE: 0			
3:			sed, no visibl	e imperfections	
4:					
5:		TIFICATION: Vis			
6: 7:		ACTURER DATE: N KNESS: 11-13 m		<del></del>	
8:		Material was	- المراجعة المساوية المراجعة	erent sheet.	
TE	ST METHOD				
1.	TESTING LABOR	RATORY: Texas R	esearch Instit	ute, 9063 Bee Cav	es Road, Austin,
2.			ous photoioniz	ation detection w	ith a 10.20 eV 1a
	TEMPERATURE:				
4.		EDIUM: Nitroge			
		YSTEM: Nitroge			
6.	OTHER CONDIT	IONS: 1 inch	cells were use	d./Detector Tempe	rature = 100C.
				ate to cells was	60 cc/min.
в.	PERMEATION TI	EST SYSTEM: In	dividual Cell	Monitoring	
CH	IALLENGE CHEMIC	AL 1	: (	COMPONENT 2 :	3
1_	CHEM NAME(s)	: Allyl Chlor	ide :	N/A :	N/A
	CAS NUMBER(s		<del></del> -	N/A	N/A
	CONC. (IF MI			N/A:	N/A
	CHEMICAL SOU			N/A	
2. 3. 4.	BREAKTHROUGH 'MIN DETECTABLE	PLES TESTED: T	through was ol	oserved after 4 ho	urs.
	SAMPLE THICKN		N/A		
	SELECTED DATA				
•	SPECILE DATA	FOIRIS N/A	<del></del>	<del></del>	<del></del>
	TIME 1.	: CONCE	NTRATION :	CONCENTRATION :	CONCENTRATION
	2.	:	:	· · · · · · · · · · · · · · · · · · ·	
	3.		:		
	4.	:			
	5.	<u>:</u>	:		
	6.	<del></del>	<del></del>	<u></u>	
	7.		<del></del>		
	8.	<del></del>			· · · · · · · · · · · · · · · · · · ·
	9.	<del>i</del>	<del></del>		·
	10.		<del></del>		
	10				
8.	OTHER OBSERVA	TIONS:			
8.		TIONS:			

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	ESCRIPTION OF P				
	: TYPE: Teflon				
	PROTECTIVE M				
				sible imperfections	
	: MANUFACTURER				
_	: PRODUCT IDEN				
	: LOT OR MANUF				
	: NOMINAL THIC				
8:	: DESCRIPTION:	Materi	al was a white to	ransparent sheet.	
TF	EST METHOD				
1.	. TESTING LABO	RATORY:_	Texas Research In	stitute, 9063 Bee Ca	ves Road, Austin, TX
2.	. ANALYTICAL M	ETHOD:	Continuous photos	onization detection	with a 10.20 eV lamp
3.	. TEMPERATURE:	22-25°C			
4.	. COLLECTION M	EDIUM:	N <sub>2</sub>		
	. COLLECTION S				
6.	. OTHER CONDIT	CIONS:	l inch cell was t	sed. Detector Temper	ature = 100C.
7.	DEVIATIONS F	ROM AST	F739 METHOD: F1	ow rate to cell was l	00 cc/min.
CH	HALLENGE CHEMIC	AL	1 :	COMPONENT 2	: 3
1.	. CHEM NAME (a)	: Cerl	on Disulfide	W/A	: \\\A
	. CAS NUMBER(s			N/A	: N/A
	. CONC. (IF HI			N/A	: N/A
4.	. CHEMICAL SOU	RCE:Mall	inckrodt :	N/A	:N/A
2. 3. 4. 5.	DATE TESTED: NUMBER OF SAM BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA	PLES TESTIME: SELIMIT PERMEATINESS: 12	.06 ppm ION RATE 10.61 (	(ug/cm)*hr)	
	TIME	:	CONCENTRATION	: CONCENTRATION	: CONCENTRATION :
		:	CONCENTRATION	: CONCENTRATION	: CONCENTRATION :
	1.	:	CONCENTRATION	: CONCENTRATION : :	: CONCENTRATION :
	1	:	CONCENTRATION	: CONCENTRATION : :	: CONCENTRATION : :
	1. 2. 3.	:	CONCENTRATION	:	: CONCENTRATION : :
	1. 2. 3. 4.	:	CONCENTRATION	:	: CONCENTRATION : : : :
	1. 2. 3. 4. 5.	:	CONCENTRATION	:	:
	1	:	CONCENTRATION	:	:
	1. 2. 3. 4. 5. 6. 7. 8. 9.	:	CONCENTRATION	:	:
	1	:	CONCENTRATION	:	: : : :
Ω	1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	:			: : : :
8.	1. 2. 3. 4. 5. 6. 7. 8. 9.	:	CONCENTRATION		: : : :
8.	1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	:			: : : :
	1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	:			: : : :

Switched from cells to standard ges

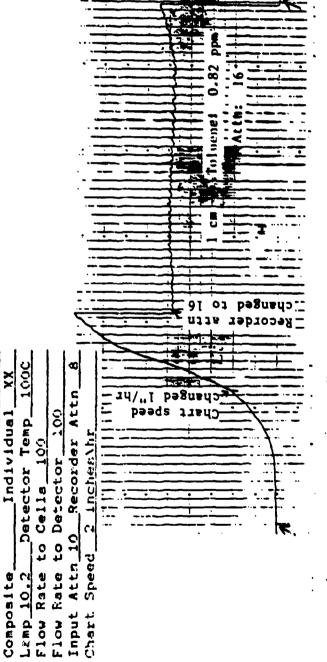
# Chemical Resistance Testing of Visor Material

### Carbon Disulfide Run I

Carbon Disulfide Run I

Sample Material

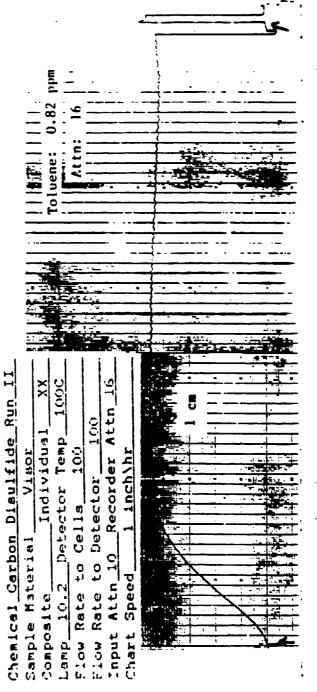
Chemical\_



• .					
1:	TYPE: Teflon				
2:	PROTECTIVE MA	TERIAL CODE: 09			
3:		ORE TEST: Unused, no	visible imperfection	ns	
	MANUTACTURER:				
		IFICATION: Visor			
-		CTURER DATE: N/A			
		NESS: 11-13 mil			
8:	DESCRIPTION:	Material was a white	transparent sheet.		
TES	T METHOD				
1.	TESTING LABOR	ATORY: Texas Research	Institute, 9063 Bee	Caves	Road, Austin,
2.	ANALYTICAL ME	THOD: Continuous phot	toionization detecti	on wit	h a 10.20 eV la
	TEMPERATURE:				<del>,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</del>
4.					
	COLLECTION SY				
6.	OTHER CONDITI	ONS: 1 inch cell was	used./Detector Tem	peratu	re = 100C.
/.	DEVIATIONS FR	ON ASTM F739 METHOD: 1	rlow rate to cell wa	s 100	cc/min.
CHA	LLENCE CHEMICA	1	: COMPONENT 2	:	3
1.	CHEM NAME (s)	: Carbon Disulfide	:N/A		N/A
2.	CAS NUMBER(s)	: 75-15-0	: N/A	<b>-</b> :-	N/A
3.	CONC 'TE MIX	) N/A	: N/A	:_	Ñ/A
4.	CHEMILAL SOUR	CF . Mallinokrodt	3° / A		N7 /A
1.	T RESULTS  DATE TESTED:	4-4-87	: N/A	•	N/A
1. 2. 4. 5.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD! STATE P SAMPLE THICKNE	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT .16 ppm ERMEATION RATE 13.56 SS: 12 mils	17)		N/A
1. 2. 4. 5.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD! STATE P	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT .16 ppm ERMEATION RATE 13.56 SS: 12 mils	17)		N/A
1. 2. 4. 5. 6. 7.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD'STATE P SAMPLE THICKNE SELECTED DATA  TIME 1.	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT .16 ppm ERMEATION RATE 13.56 SS: 12 mils	II) B (ug/cm2*hr)	N :	CONCENTRATION
1. 2. 4. 5. 6. 7.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD1 STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2.	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT .16 ppm ERMEATION RATE 13.56 SS: 12 mils POINTS N/A	II) B (ug/cm2*hr)	N :	
1. 2. 4. 5. 6. 7.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD: STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2.	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT .16 ppm ERMEATION RATE 13.56 SS: 12 mils POINTS N/A	II) B (ug/cm2*hr)	N :	
1. 2. 4. 5. 6. 7.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD'STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4.	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT .16 ppm ERMEATION RATE 13.56 SS: 12 mils POINTS N/A	II) B (ug/cm2*hr)	N :	
1. 2. 4. 5. 6. 7.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEADY STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 4. 5.	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT .16 ppm ERMEATION RATE 13.56 SS: 12 mils POINTS N/A	II) B (ug/cm2*hr)	N :	
1. 2. 4. 5. 6. 7.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD'STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6.	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT .16 ppm ERMEATION RATE 13.56 SS: 12 mils POINTS N/A	II) B (ug/cm2*hr)	N :	
1. 2. 4. 5. 6. 7.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD' STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7.	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT .16 ppm ERMEATION RATE 13.56 SS: 12 mils POINTS N/A	II) B (ug/cm2*hr)	N :	
1. 2. 4. 5. 6. 7.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD'STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7.	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT .16 ppm ERMEATION RATE 13.56 SS: 12 mils POINTS N/A	II) B (ug/cm2*hr)	N :	
1. 2. 4. 5. 6. 7.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD: STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT .16 ppm ERMEATION RATE 13.56 SS: 12 mils POINTS N/A	II) B (ug/cm2*hr)	:	
1. 2. 4. 5. 6. 7.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD'STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7.	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT .16 ppm ERMEATION RATE 13.56 SS: 12 mils POINTS N/A	II) B (ug/cm2*hr)	:	
1. 2. 4. 5. 6. 7.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD'S STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 4. 5. 6. 7. 8. 9.	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT_16 ppm ERMEATION RATE 13.58 SS: 12 mils POINTS N/A  : CONCENTRATION	II) B (ug/cm2*hr)	:	
1. 2. 4. 5. 6. 7.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD: STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT_16 ppm ERMEATION RATE 13.58 SS: 12 mils POINTS N/A  : CONCENTRATION	II) B (ug/cm2*hr)	:	
1. 2. 4. 5. 6. 7.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD'S STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 4. 5. 6. 7. 8. 9.	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT_16 ppm ERMEATION RATE 13.58 SS: 12 mils POINTS N/A  : CONCENTRATION	II) B (ug/cm2*hr)	:	
1. 2. 4. 5. 6. 7.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD' STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9. 10 OTHER OBSERVAT	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT_16 ppm ERMEATION RATE 13.58 SS: 12 mils POINTS N/A  : CONCENTRATION	II) B (ug/cm2*hr)	:	
1. 2. 4. 5. 6. 7.	T RESULTS  DATE TESTED: NUMBER OF SAMP BREAKTHROUGH T MIN DETECTABLE STEAD'S STATE P SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 4. 5. 6. 7. 8. 9. 10 OTHER OBSERVAT	4-4-87 LES TESTED: One (Run IME: 94 minutes LIMIT_16 ppm ERMEATION RATE 13.58 SS: 12 mils POINTS N/A  : CONCENTRATION	II)  B (ug/cm <sub>2</sub> *hr)  N : CONCENTRATIO : : : : : : : : : : : : : : : : : : :	: : : : : : : : : : : : : : : : : : : :	

Chemical Resistance Testing of Visor Material

## Carbon Disulfide Run li

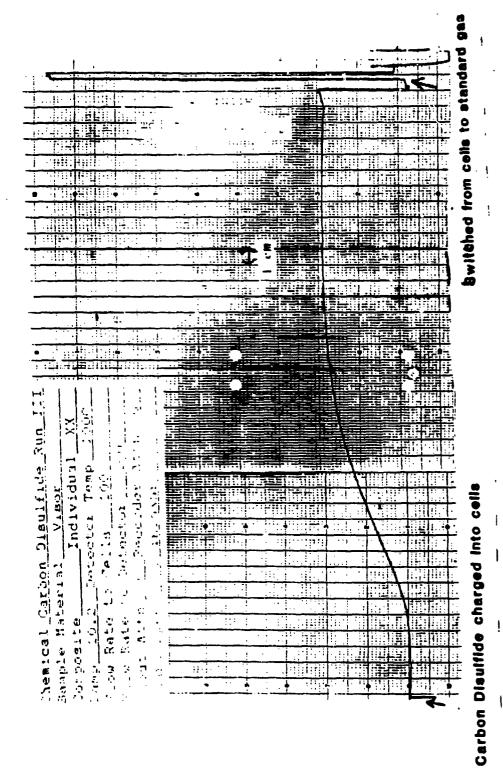


Carbon Disulfide charged into cells

Switched from cells to standard gas

	ESCRIPTION OF PRODUCT EVALUATED		
1	: TYPE: Teflon		
	: PROTECTIVE MATERIAL CODE: 09		
3	: CONDITION BEFORE TEST: Unused, n	o visible imperfection	ns
	: MANUFACTURER: Dupont		
	: PRODUCT IDENTIFICATION: Visor		
	: LOT OR MANUFACTURER DATE: N/A	· · · · · · · · · · · · · · · · · · ·	
	: NOMINAL THICKNESS: 11-13 mil		
	: DESCRIPTION: Material was a whit	e transparent sheet.	
T	TEST METHOD		
1	. TESTING LABORATORY: Toxas Research	h Institute, 9063 Bee	Caves Road, Austin, T
2	. ANALYTICAL METHOD: Continuous ph	otoionization detecti	on with a 10.20 eV lam
3	. TEMPERATURE: 22-25°C		
4	. COLLECTION MEDIUM: N2		
5	. COLLECTION SYSTEM: N2 .		
. 6	. OTHER CONDITIONS: 1 inch cell w.	as used. /Detector Tem	perature = 100C.
7	- DEVIATIONS FROM ASTM F739 METHOD:	Flow rate to cell was	100 cc/min-
C	HALLENGE CHEMICAL 1	: .COMPONENT 2	: 3
1	. CHEM NAME(s): Carbon Disulfide	: N/A	: N/A
2	. CAS NUMBER(6): 75-15-0	: N/A	N/A
3	. CONC. (IF MIX) N/A	N/A	: N/A
	. CHEMICAL SOURCE: Mallinckrodt	N/A	: N/A
2 3 4 5	DATE TESTED: 4-6-87  NUMBER OF SAMPLES TESTED: One (Ruber of Samples Tested: One (Ruber of Samples of Samples of Samples of Steady State Permeation Rate 7.	27 (ug/cm2*hr)	
	SAMPLE THICKNESS: 12 mils	.,	
•	A SELECTED DATA POINTS N/A		
•	. SELECTED DATA POINTS N/A  TIME : CONCENTRATION	ON : CONCENTRATIO	N : CONCENTRATION
,	TIME : CONCENTRATION	ON : CONCENTRATIO	N : CONCENTRATION :
•	TIME : CONCENTRATION : :	ON : CONCENTRATIO	N : CONCENTRATION : :
•	TIME : CONCENTRATION : : : : : : : : : : : : : : : : : : :	ON : CONCENTRATIO	N : CONCENTRATION : :
•	TIME : CONCENTRATION : : : : : : : : : : : : : : : : : : :	ON : CONCENTRATIO	N : CONCENTRATION : : : : : : : : : : : : : : : : : : :
•	TIME : CONCENTRATION : : : : : : : : : : : : : : : : : : :	ON : CONCENTRATIO	N : CONCENTRATION : : : :
•	TIME : CONCENTRATION : : : : : : : : : : : : : : : : : : :	ON : CONCENTRATIO	N : CONCENTRATION : : : : :
•	TIME : CONCENTRATION : : : : : : : : : : : : : : : : : : :	ON : CONCENTRATIO	N : CONCENTRATION : : : : : : :
•	TIME : CONCENTRATION : : : : : : : : : : : : : : : : : : :	ON : CONCENTRATIO	N : CONCENTRATION : : : : : : : :
•	TIME : CONCENTRATION : : : : : : : : : : : : : : : : : : :	ON : CONCENTRATIO : : : : : : : : :	N : CONCENTRATION : : : : : : : : : : : : : : : : : : :
,	TIME : CONCENTRATION : : : : : : : : : : : : : : : : : : :	ON : CONCENTRATIO	N : CONCENTRATION : : : : : : : : : : : : : : : : : : :
	TIME : CONCENTRATION : : : : : : : : : : : : : : : : : : :	ON : CO NCE NTRATIO : : : : : : : : : : : : : : : : : : :	N : CONCENTRATION : : : : : : : : : : : : : : : : : : :

Chemical Resistance Testing of Visor Material Carbon Disulfide Run III



DESCRIPTION OF PRODUCT EVALUATED

3:		ERIAL CODE: 09			
J.		RE TEST: Unused, no v	visible imperfection	ns	
4:	MANUFACTURER:				
5:	PRODUCT IDENTI				
6:	LOT OR MANUFAC				
7:	NOMINAL THICKN				
ಕ:	DESCRIPTION:	Material was a white t	ransparent sheet.		
TE	ST METHOD				
ì.	TESTING LABORA	TORY: Texas Research I	Institute, 9063 Bee	Caves	Road, Austin,
2.		HOD: Continuous photo			
	TEMPERATURE: 2				
4.	COLLECTION MED	IUM: No			
5.	COLLECTION SYS	TEM: No			
6.	OTHER CONDITIO	NS: 1 inch cells wer	e used. Detector I	emperat	ure = 100C.
7.	DEVIATIONS FRO	M ASTM F739 METHOD: I			
CH	allenge Chemical	. 1	: COMPONENT 2	:	3
1.	CHEM NAME(s):	Ethyl Acetate	. N/A	•	N/A
	CAS NUMBER(s):		: N/A		N/A
	CONC. (IF MIX)		: N/A		N/A
4.	•		: N/A		N/A
TE:		4-7-87			
1. 2. 3. 4. 5.	DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE	ES TESTED: Three  ME: No breakthrough t LIMIT .27 ppm  RMEATION RATE N/A	was observed after	3 hours	3.
1. 2. 3. 4. 5.	DATE TESTED:  NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES	ES TESTED: Three ME: No breakthrough t LIMIT .27 ppm RMEATION RATE N/A S: 12 mils		3 hours	3.
1. 2. 3. 4. 5.	DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F	ES TESTED: Three  ME: No breakthrough v LIMIT .27 ppm  RMEATION RATE N/A  S: 12 mils OINTS N/A			
1. 2. 3. 4. 5.	DATE TESTED:  NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES	ES TESTED: Three ME: No breakthrough t LIMIT .27 ppm RMEATION RATE N/A S: 12 mils			CONCENTRATION
1. 2. 3. 4. 5.	DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F  TIME  1. 2.	ES TESTED: Three  ME: No breakthrough v LIMIT .27 ppm  RMEATION RATE N/A  S: 12 mils OINTS N/A			
1. 2. 3. 4. 5.	DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F  TIME  1. 2. 3.	ES TESTED: Three  ME: No breakthrough v LIMIT .27 ppm  RMEATION RATE N/A  S: 12 mils OINTS N/A			
1. 2. 3. 4. 5.	DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F  TIME  1. 2. 3. 4.	ES TESTED: Three  ME: No breakthrough v LIMIT .27 ppm  RMEATION RATE N/A  S: 12 mils OINTS N/A			
1. 2. 3. 4. 5.	DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F  TIME  1. 2. 3. 4. 5.	ES TESTED: Three  ME: No breakthrough v LIMIT .27 ppm  RMEATION RATE N/A  S: 12 mils OINTS N/A		: : : :	
1. 2. 3. 4. 5.	DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F  TIME  1. 2. 3. 4. 5. 6.	ES TESTED: Three  ME: No breakthrough v LIMIT .27 ppm  RMEATION RATE N/A  S: 12 mils OINTS N/A			
1. 2. 3. 4. 5. 6.	DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F  TIME  1. 2. 3. 4. 5. 6. 7.	ES TESTED: Three  ME: No breakthrough v LIMIT _27 ppm  RMEATION RATE N/A  S: 12 mils  CONCENTRATION : CONCENTRATION : : : : : :		: : : :	
1. 2. 3. 4. 5.	DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F  TIME  1. 2. 3. 4. 5. 6. 7. 8.	ES TESTED: Three  ME: No breakthrough v LIMIT _27 ppm  RMEATION RATE N/A  S: 12 mils  CONCENTRATION: : : : : : : :		: : : :	
1. 2. 3. 4. 5.	DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F  TIME  1. 2. 3. 4. 5. 6. 7. 8.	ES TESTED: Three  ME: No breakthrough v LIMIT _27 ppm  RMEATION RATE N/A  S: 12 mils  CONCENTRATION: : : : : : : :		: : : :	
1. 2. 3. 4. 5.	DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F  TIME  1. 2. 3. 4. 5. 6. 7.	ES TESTED: Three  ME: No breakthrough v LIMIT _27 ppm  RMEATION RATE N/A  S: 12 mils  CONCENTRATION: : : : : : : :		: : : :	
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	ES TESTED: Three  ME: No breakthrough v LIMIT _27 ppm  RMEATION RATE N/A  S: 12 mils  OINTS N/A  : CONCENTRATION : : : : : : : : : :		: : : :	
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F  TIME  1. 2. 3. 4. 5. 6. 7. 8.	ES TESTED: Three  ME: No breakthrough v LIMIT _27 ppm  RMEATION RATE N/A  S: 12 mils  OINTS N/A  : CONCENTRATION : : : : : : : : : :		: : : :	
1. 2. 3. 4. 5. 6. 7.	DATE TESTED: NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA F  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	ES TESTED: Three  ME: No breakthrough v LIMIT _27 ppm  RMEATION RATE N/A  S: 12 mils  OINTS N/A  : CONCENTRATION : : : : : : : : : :		: : : :	

# Chemical Resistance Testing of Visor Material

## Ethyl Acetate

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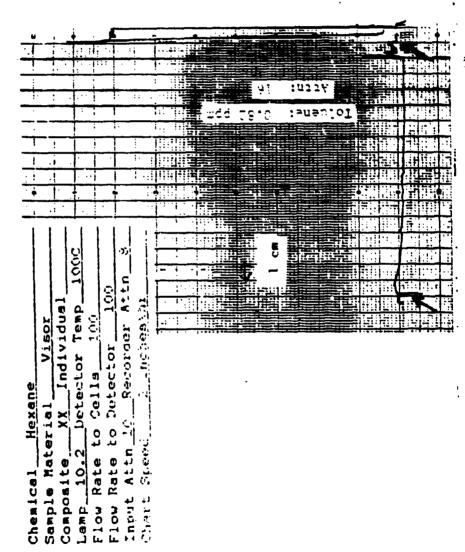
Ethyl Acetate charged into cells

Switched from cells to standard gas

	TYPE: Teflon					
		TERIAL CODE: 09				
3:	CONDITION BEF	ORE TEST: Unuse	d. no visible	imperfecti	ons	
	MANUFACTURER:					
		IFICATION: Visc	r			
		CTURER DATE: N/A				
		NESS: 11-13 mil				
		Material was a	white transn	Tent sheet.		
٠.		actives was a	The cramb,	Tene Breeze		
TES	ST METHOD					
1.	TESTING LABOR	ATORY: Texas Res	earch Institu	ite, 9063 Be	e Caves	Road, Austin, T
			s photoioniza	stion detect	ion wit	h a 10.20 eV lam
3.	TEMPERATURE:	22-25°C				
4.	COLLECTION ME	DIUM: N2				
5.	COLLECTION SY	STEM: N2				
6.	OTHER CONDITI	ONS: 1 inch ce	lls were use	d./Detector	Tempera	ture = 100C.
7-	DEVIATIONS FE	OM ASIM F739 ME	HOD: Flow r.	te to cells	were !	00 cc/min-
CH.	ALLENGE CHEMICA	L 1	: C	OMPONENT 2	:	3
			:	TO / A	:	93 (4
	CHEM RAME (6)			W/A		Y/A
	CAS NUMBER(s)		:	N/A	:_	N/A
	CONC. (IF MIX CHEMICAL SOUR			N/A N/A		N/A N/A
	ST RESULTS		······································			"
123						<i>(</i> ·
	DATE TESTED:					
2.	NUMBER OF SAME	LES TESTED: The				
2. 3.	NUMBER OF SAME BREAKTHROUGH T	LES TESTED: The		served after	3.0 h	ours.
2. 3. 4.	NUMBER OF SAME BREAKTHROUGH T MIN DETECTABLE	LES TESTED: The IME: No breakt! LIMIT 31 ppm	rough was ob	served after	3.0 h	outs.
2. 3. 4. 5.	NUMBER OF SAME BREAKTHROUGH T MIN DETECTABLE STEADY STATE F	LES TESTED: The IME: No breakth LIMIT .31 ppm PERMEATION RATE	rough was ob	served after	3.0 h	outs.
2. 3. 4. 5.	NUMBER OF SAME BREAKTHROUGH I MIN DETECTABLE STEADY STATE F SAMPLE THICKNE	LES TESTED: The TIME: No breakth LIMIT .31 ppm PERMEATION RATE SS: 12 mils	rough was ob	served after	3.0 h	ours.
2. 3. 4. 5. 6.	NUMBER OF SAME BREAKTHROUGH T MIN DETECTABLE STEADY STATE F	LES TESTED: The TIME: No breakth LIMIT .31 ppm PERMEATION RATE SS: 12 mils	rough was ob	served after		outs.
2. 3. 4. 5. 6.	NUMBER OF SAME BREAKTHROUGH I MIN DETECTABLE STEADY STATE F SAMPLE THICKNE	LES TESTED: The IME: No breakth LIMIT .31 ppm PERMEATION RATE SS: 12 mils POINTS N/A	rough was ob			
2. 3. 4. 5. 6.	NUMBER OF SAME BREAKTHROUGH T MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA TIME 1.	LES TESTED: The IME: No breakth LIMIT .31 ppm PERMEATION RATE SS: 12 mils POINTS N/A	N/A  TRATION:			
2. 3. 4. 5. 6.	NUMBER OF SAME BREAKTHROUGH I MIN DETECTABLE STEADY STATE F SAMPLE TRICKNE SELECTED DATA TIME 1. 2.	LES TESTED: The IME: No breakth LIMIT .31 ppm PERMEATION RATE SS: 12 mils POINTS N/A	N/A			
2. 3. 4. 5. 6.	NUMBER OF SAME BREAKTHROUGH I MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA TIME 1. 2. 3.	LES TESTED: The IME: No breakth LIMIT .31 ppm PERMEATION RATE SS: 12 mils POINTS N/A	N/A  RATION:			
2. 3. 4. 5. 6.	NUMBER OF SAME BREAKTHROUGH TO MIN DETECTABLE STEADY STATE IN SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5.	LES TESTED: The IME: No breakth LIMIT .31 ppm PERMEATION RATE SS: 12 mils POINTS N/A	N/A  TRATION:			
2. 3. 4. 5. 6.	NUMBER OF SAME BREAKTHROUGH TAMIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6.	LES TESTED: The IME: No breakth LIMIT .31 ppm PERMEATION RATE SS: 12 mils POINTS N/A	N/A  RATION:			
2. 3. 4. 5. 6.	NUMBER OF SAME BREAKTHROUGH TO MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7.	LES TESTED: The IME: No breakth LIMIT .31 ppm PERMEATION RATE SS: 12 mils POINTS N/A	N/A  RATION:			CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAME BREAKTHROUGH TAMIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8.	LES TESTED: The IME: No breakth LIMIT .31 ppm PERMEATION RATE SS: 12 mils POINTS N/A	N/A  RATION:			CONCENTRATION
2. 3. 4. 5. 6.	NUMBER OF SAME BREAKTHROUGH TO MIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7.	LES TESTED: The IME: No breakth LIMIT .31 ppm PERMEATION RATE SS: 12 mils POINTS N/A	N/A  RATION:			CONCENTRATION
2. 3. 4. 5.	NUMBER OF SAME BREAKTHROUGH TAMIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8.	LES TESTED: The IME: No breakth LIMIT .31 ppm PERMEATION RATE SS: 12 mils POINTS N/A	N/A  RATION:			CONCENTRATION
2. 3. 4. 5. 6. 7.	NUMBER OF SAME BREAKTHROUGH TMIN DETECTABLE STEADY STATE F SAMPLE TRICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	CLES TESTED: The Time: No breakth In the Limit .31 ppm Permeation RATE .SS: 12 mils POINTS N/A CONCENT	N/A  RATION:			CONCENTRATION
2. 3. 4. 5. 6. 7.	NUMBER OF SAME BREAKTHROUGH TMIN DETECTABLE STEADY STATE F SAMPLE THICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8.	CLES TESTED: The Time: No breakth In the Limit .31 ppm Permeation RATE .SS: 12 mils POINTS N/A CONCENT	N/A  RATION:			CONCENTRATION
2. 3. 4. 5. 6. 7.	NUMBER OF SAME BREAKTHROUGH TMIN DETECTABLE STEADY STATE F SAMPLE TRICKNE SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	CLES TESTED: The Time: No breakth In the Limit .31 ppm Permeation RATE .SS: 12 mils POINTS N/A CONCENT	N/A  RATION:			CONCENTRATION

## Chemical Resistance Testing of Visor Material

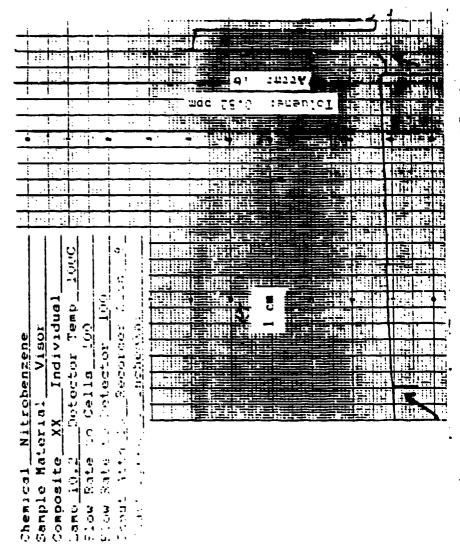
## Hexane



DE:	SCRIPTION OF P	RODUCT E	VALUATED				
1:	TYPE: Teflon						
2:	PROTECTIVE M		CODE: 09				
3:			T: Unused, no vi	sibl	e imperfections	<u> </u>	
	MANUFACTURER						- <del> </del>
5:							
	LOT OR MANUF						
7:	NOMINAL THIC						
		_	al was a white to		and chase.		
8:	DESCRIPTION:	Materi	at was a wille c.	ensp	Brant Dieec.		
TE	SI MEIHOD				•		
1.	TESTING LABO	RATORY:	Texas Research In	stit	ute, 9063 Bee (	Caves	Road, Austin, I
2.	ANALYTICAL M	ETHOD:	Continuous photos	oniz	ation detection	n wit	h a 10.20 eV lam
	TEMPERATURE:				<u></u>		
4.							
5.	**						
			inch cells were	د م مرد	/Deresta: To-		= 100C
7.	DEVIATIONS F	ROM ASIN	F739 METHOD: F	LOW I	ate to cells w	as 1(	OU cc/min.
CR	allenge Chemic	AL	1 :	C	OMPONENT 2	:	3
1.	CHEM NAME (s)	: Nit:	robenzene	• !	N/A	<b>:</b>	N/A
2.	CAS NUMBER(s	): <del>98-</del> 9	5-3		N/A	<b>−</b> :−	N/A
	CONC. (IF MI				N/A	_:-	N/A
4.	-		inckrodt		N/A	—;—	N/A
2. 3. 4. 5. 6.	MIN DETECTABLE STEADY STATE SAMPLE THICKN	PLES TESTIME: No. E LIMIT PERMEAT JESS: 1	STED: Three  o breakthrough was  o 04 ppm  ION RATE N/A  2 mils	s obs	erved after 3.	8 ho	ers.
7.	SELECTED DATA	POINTS	N/A				
	TIME	:	CONCENTRATION	:	CONCENTRATION	:	CONCENTRATION
	2.	:	· · · · · · · · · · · · · · · · · · ·	_:		:	
	3.	:		:		:	
	4.	:		:		:	······································
	5.	<del></del>				:	
	6.	<del></del>		<del>- ; -</del>			<del></del>
	7.	<del>:</del>		÷		-÷-	
		<del></del>		÷		<del>-</del> ÷	<del></del>
	8	<del></del>		÷	<del></del>	<del>-</del> -	<del> </del>
	9.	:				_ <u>-</u> -	
	10	<u> </u>		<u>:</u>		<u> </u>	
_							
8.	OTHER OBSERVA	ATIONS:	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				
<b>S</b> 0	UACE OF DATA						
	Samoles	Were Tu	n by Denise McDon	ald o	on April 6. 198	37.	

Chemical Resistance Testing of Visor Material

## Nitrobenzene



•	DESCRIPTION OF PRODUCT EVALUATED		
	1: TYPE: Teflon		
	2: PROTECTIVE MATERIAL CODE: 09		
	3: CONDITION BEFORE TEST: Unused, no	weethle (manfactions	
		Visible imperiections	<del></del>
	4: MANUFACTURER: Dupont 5: PRODUCT IDENTIFICATION: Visor	<del></del>	
	6: LOT OR MANUFACTURER DATE: N/A		·
	7: NOMINAL THICKNESS: 11-13 mil	<del></del>	<del></del>
	8: DESCRIPTION: Material was a white	troppostant about	<del></del>
	6: DESCRIPTION: Material was a white	transparent sneet.	
2.	TEST METHOD		
	1. TESTING LABORATORY: Texas Research	Institute 9063 Res Cas	ves Road Austin T
	2. ANALYTICAL METHOD: Continuous pho	toionization detection a	ith a 10.20 av lam
	3. TEMPERATURE: 22-25°C	totonization detection w	10120 64 182
	4. COLLECTION MEDIUM: Nitrogen		
	5. COLLECTION SYSTEM: Nitrogen		
	6. OTHER CONDITIONS: 1 inch cells w	ere used /Detector Torre	rature a 100c
	7. DEVIATIONS FROM ASTM F739 METHOD:	Flow sate to collector tempe	40 00/01-
	8. PERMEATION TEST SYSTEM: Individua		OO CC/MIU!
	o. PERMENTION TEST STREET: INGIVIOUS	r cerr monitoring	
3.	CHALLENGE CHEMICAL 1	: COMPONENT ?	3
	1. CHEM NAME(s): Trichloroethylene	N/A	N/A
	2. CAS NUMBER(s): 79-01-6	: N/A :	N/A
	3. CONC. (IF MIX) N/A	: N/A :	N/A
	4. CHEMICAL SOURCE: Aldrich	: N/A :	N/A
	1. DATE TESTED: 6-29-87 2. NUMBER OF SAMPLES TESTED: Three 3. BREAKTHROUGH TIME: No breakthrough 4. MIN DETECTABLE LIMIT .21 ppm 5. STEADY STATE PERMEATION RATE N/A 6. SAMPLE THICKNESS: 12 mils 7. SELECTED DATA POINTS N/A	was observed after 4.1	hours
	TIME : CONCENTRATIO	N : CONCENTRATION :	CONCENTRATION
	1. :		
		<del></del>	
	3.		<del> </del>
	4		
	5. :		<del></del>
	6		·
	7.		·
	8. :		·
	9. :		·
	10:	:	
	D AMILED ANADESIA		
	8. OTHER OBSERVATIONS:		····
_			
5.	SOURCE OF DATA		
	Samples were run by Denise McDo	nald on June 29, 1987.	

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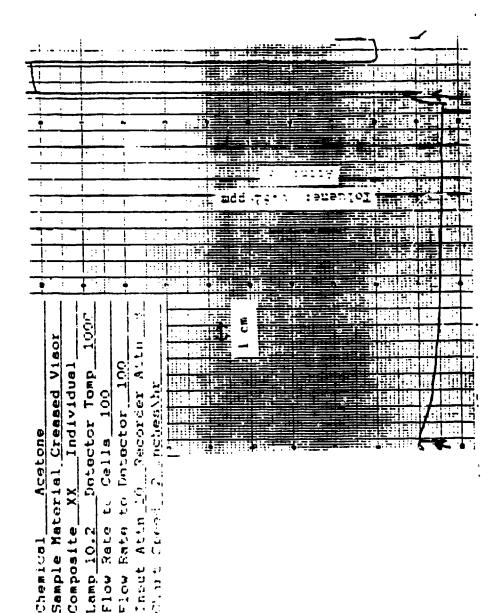
1. DESCRIPTION OF PRODUCT EVALUATED

	NAL THICKNE	URER DATE: N/A SS: 11-13 mil aterial was a white	transparent sheet.	
/; NOM			transparent sheet.	
8: DESC				
TEST MET	ТНОД			
			Institute, 9063 Bee Ca	
			oionization detection	with a 10.20 ev .
	ERATURE: 22	UM: Nitrogen		
		EM: Nitrogen		
			re used./Detector Temp	peratura = 100C.
7. DEVI	ATIONS FROM	ASTM F739 METHOD:	Flow rate to cells was	60 cc/min
8. PER	EATION TEST	SYSTEM: Individual	cell monitoring	- CC/MIN
CHALLEN	E CHEMICAL	1	: COMPONENT 2	: 3
1. CHEN	NAME(s):	Vinyl Acetate	: N/A	: N/A
2. CAS				
	MOTIVATION (D).	108-05-4	: N/A	: N/A
3. CON	(IF MIX)		: N/A N/A	: N/A : N/A
		N/A		
	(IF MIX) MICAL SOURCE	N/A	:N/A	: N/A
4. CHE	C. (IF MIX) MICAL <del>SOURCE</del> SULTS	N/A	:N/A	: N/A
TEST RES	C. (IF MIX) MICAL <del>SOURCE</del> SULTS	N/A : Aldrich -30-87	:N/A	: N/A
TEST RES 1. DATE 2. NUMBE 3. BREAN	C. (IF MIX) MICAL SOURCE SULTS TESTED: 6 TR OF SAMPLE THROUGH TIM	N/A :Aldrich  -30-87 S TESTED: Three E: No breakthrough	:N/A	: N/A : N/A
TEST RES 1. DATE 2. NUMBE 3. BREAM 4. MIN I	C. (IF MIX) HICAL SOURCE BULTS TESTED: 6 ER OF SAMPLE CTHROUGH TIM DETECTABLE L	N/A :Aldrich  -30-87 S TESTED: Three E: No breakthrough IMIT .50 ppm	: N/A : N/A	: N/A : N/A
TEST RES 1. DATE 2. NUMBE 3. BREAN 4. MIN I 5. STEAL	C. (IF MIX) HICAL SOURCE BULTS TESTED: 6 IR OF SAMPLE CTHROUGH TIM DETECTABLE L DY STATE PER	N/A :Aldrich  -30-87 S TESTED: Three E: No breakthrough IMIT .50 ppm MEATION RATE N/A	: N/A : N/A	: N/A : N/A
TEST RES  1. DATE 2. NUMBE 3. BREAD 4. MIN I 5. STEAL 6. SAMPI	C. (IF MIX) HICAL SOURCE BULTS TESTED: 6 TR OF SAMPLE THROUGH TIM DETECTABLE L DY STATE PER LE THICKNESS	N/A :Aldrich  -30-87 S TESTED: Three E: No breakthrough IMIT .50 ppm MEATION RATE N/A : 12 mils	: N/A : N/A	: N/A : N/A
TEST RES  1. DATE 2. NUMBE 3. BREAD 4. MIN I 5. STEAL 6. SAMPI	C. (IF MIX) HICAL SOURCE BULTS TESTED: 6 IR OF SAMPLE CTHROUGH TIM DETECTABLE L DY STATE PER	N/A :Aldrich  -30-87 S TESTED: Three E: No breakthrough IMIT .50 ppm MEATION RATE N/A : 12 mils	: N/A : N/A	: N/A : N/A
TEST RES  1. DATE 2. NUMBE 3. BREAN 4. MIN I 5. STEAL 6. SAMPI 7. SELECT	C. (IF MIX) HICAL SOURCE BULTS TESTED: 6 TR OF SAMPLE THROUGH TIM DETECTABLE L DY STATE PER LE THICKNESS	N/A :Aldrich  -30-87 S TESTED: Three E: No breakthrough IMIT .50 ppm MEATION RATE N/A : 12 mils	: N/A : N/A was observed after 4.5	: N/A N/A
TEST RES  1. DATE 2. NUMBE 3. BREAN 4. MIN I 5. STEAL 6. SAMPI 7. SELECT	C. (IF MIX) HICAL SOURCE SULTS TESTED: 6 ER OF SAMPLE CTHROUGH TIM DETECTABLE L DY STATE PER LE THICKNESS CTED DATA PO	N/A :Aldrich  -30-87 S TESTED: Three E: No breakthrough IMIT .50 ppm MEATION RATE N/A : 12 mils INTS N/A	: N/A : N/A  was observed after 4.5	: N/A N/A
TEST RES  1. DATE 2. NUMBE 3. BREAD 4. MIN I 5. STEAL 6. SAMPI 7. SELECT	C. (IF MIX) HICAL SOURCE SULTS TESTED: 6 ER OF SAMPLE CTHROUGH TIM DETECTABLE L DY STATE PER LE THICKNESS CTED DATA PO	N/A :Aldrich  -30-87 S TESTED: Three E: No breakthrough IMIT .50 ppm MEATION RATE N/A : 12 mils INTS N/A	: N/A : N/A  was observed after 4.5	: N/A N/A
TEST RES  1. DATE 2. NUMBE 3. BREAN 4. MIN I 5. STEAL 6. SAMPI 7. SELECT	C. (IF MIX) HICAL SOURCE SULTS TESTED: 6 ER OF SAMPLE CTHROUGH TIM DETECTABLE L DY STATE PER LE THICKNESS CTED DATA PO	N/A :Aldrich  -30-87 S TESTED: Three E: No breakthrough IMIT .50 ppm MEATION RATE N/A : 12 mils INTS N/A	: N/A : N/A  was observed after 4.5	: N/A N/A
TEST RES  1. DATE 2. NUMBE 3. BREAN 4. MIN I 5. STEAN 6. SAMPI 7. SELECT	C. (IF MIX) HICAL SOURCE SULTS TESTED: 6 ER OF SAMPLE CTHROUGH TIM DETECTABLE L DY STATE PER LE THICKNESS CTED DATA PO	N/A :Aldrich  -30-87 S TESTED: Three E: No breakthrough IMIT .50 ppm MEATION RATE N/A : 12 mils INTS N/A	: N/A : N/A  was observed after 4.5	: N/A N/A
TEST RES  1. DATE 2. NUMBE 3. BREAN 4. MIN I 5. STEAN 6. SAMPI 7. SELECT	C. (IF MIX) HICAL SOURCE SULTS TESTED: 6 ER OF SAMPLE CTHROUGH TIM DETECTABLE L DY STATE PER LE THICKNESS CTED DATA PO	N/A :Aldrich  -30-87 S TESTED: Three E: No breakthrough IMIT .50 ppm MEATION RATE N/A : 12 mils INTS N/A	: N/A : N/A  was observed after 4.5	: N/A N/A
TEST RES  1. DATE 2. NUMBE 3. BREAN 4. MIN I 5. STEAL 6. SAMPI 7. SELECT  1 3 4 5	C. (IF MIX) HICAL SOURCE SULTS TESTED: 6 ER OF SAMPLE CTHROUGH TIM DETECTABLE L DY STATE PER LE THICKNESS CTED DATA PO	N/A :Aldrich  -30-87 S TESTED: Three E: No breakthrough IMIT .50 ppm MEATION RATE N/A : 12 mils INTS N/A	: N/A : N/A  was observed after 4.5	: N/A N/A
1. DATE 2. NUMBE 3. BREAD 4. MIN I 5. STEAL 6. SAMPI 7. SELECT 1 3 4 5 8	C. (IF MIX) HICAL SOURCE SULTS TESTED: 6 ER OF SAMPLE CTHROUGH TIM DETECTABLE L DY STATE PER LE THICKNESS CTED DATA PO	N/A :Aldrich  -30-87 S TESTED: Three E: No breakthrough IMIT .50 ppm MEATION RATE N/A : 12 mils INTS N/A	: N/A : N/A  was observed after 4.5	: N/A N/A
1. DATE 2. NUMBE 3. BREAN 4. MIN I 5. STEAN 6. SAMPI 7. SELECT	C. (IF MIX) HICAL SOURCE SULTS TESTED: 6 ER OF SAMPLE CTHROUGH TIM DETECTABLE L DY STATE PER LE THICKNESS CTED DATA PO	N/A :Aldrich  -30-87 S TESTED: Three E: No breakthrough IMIT .50 ppm MEATION RATE N/A : 12 mils INTS N/A	: N/A : N/A  was observed after 4.5	: N/A N/A
1. DATE 2. NUMBE 3. BREAD 4. MIN I 5. STEAL 6. SAMPI 7. SELECT 1 3 4 5 8	C. (IF MIX) HICAL SOURCE SULTS TESTED: 6 ER OF SAMPLE CTHROUGH TIM DETECTABLE L DY STATE PER LE THICKNESS CTED DATA PO	N/A :Aldrich  -30-87 S TESTED: Three E: No breakthrough IMIT .50 ppm MEATION RATE N/A : 12 mils INTS N/A : CONCENTRATION : : : : : :	: N/A : N/A  was observed after 4.5	: N/A N/A

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٠.	TYPE: Teflon		
2:			
3:		visible imperfections	
4:			
5:			
6:			
7:	NOMINAL THICKNESS: 11-13 mil		
8:	DESCRIPTION: Material was a white	transparent sheet. Sample was creased	using
	CHEMFAB Fold Resistance Test procedu	ure of 5 September 1986.	
TE	ST METHOD	•	
1.	TESTING LABORATORY: Texas Research	Institute, 9063 Bee Caves Road, Austin	, TX
		oionization detection with a 10.20 eV	
3.			
	COLLECTION MEDIUM: N2		
	COLLECTION SYSTEM: N2		
6.	OTHER CONDITIONS: 1 inch cells we	re used./Detector Temperature = 100 C.	
	DEVIATIONS FROM ASTM F739 METHOD:		
. •			
CH.	ALLENGE CHEMICAL 1	: COMPONENT 2 : 3	
		:	
	CHEM NAME(s): Acetone	: N/A : N/A	
2.	CAS NUMBER(s): 67-64-1	: N/A : N/A	
3.	CONC. (IF MIX) N/A	: N/A : N/A	
4.	CHEMICAL SOURCE: Mallinckrodt	: N/A : N/A	
	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough	was observed after 4 hours.	
4. 5. 6.	MIN DETECTABLE LIMIT .21 ppm STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 12 mils		
4. 5. 6.	STEADY STATE PERMEATION RATE N/A		
4. 5. 6.	STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 12 mils		ON
4. 5. 6.	STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. :		)N
4. 5. 6.	STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 12 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. :		ON
4. 5. 6.	STEADY STATE PERMEATION RATE N/A SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRATION 1. :		ON .
4. 5. 6.	STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 12 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. :		ON .
4. 5. 6.	STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 12 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. :		N
4. 5. 6.	STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 12 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. :		NO
4. 5. 6.	STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 12 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. :		ON
4. 5. 6.	STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 12 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :		ON
4. 5. 6.	STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 12 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. : 6. : 7. :		ON .
4. 5. 6.	STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 12 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :		ON
4. 5. 6. 7.	STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 12 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	CONCENTRATION : CONCENTRATION:	ON .
4. 5. 6. 7.	STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 12 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	CONCENTRATION : CONCENTRATION:	ON
4. 5. 6. 7.	STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 12 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	CONCENTRATION : CONCENTRATION:	ON
4. 5. 6. 7.	STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 12 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	CONCENTRATION : CONCENTRATION:	ON
4. 5. 6. 7.	STEADY STATE PERMEATION RATE N/A  SAMPLE THICKNESS: 12 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	CONCENTRATION : CONCENTRATION:	)N

## Acetohe



١.	: TYPE: Teflon					
2:		RIAL CODE: 09				
3:		RE TEST: Unused, 1	no visibl	e imperfectio	ns	
_	MANUFACTURER:					
5:		ICATION: Visor				
6:	LOT OR MANUFACT					
7:	=					
8:		daterial was a whitesistance Test production				as creased us:
TE	EST METHOD					
1.	. TESTING LABORAT	CORY: Texas Researd	ch Instit	ute. 9063 Bee	Caves R	oad. Austin. 1
		IOD: Gas Chromatos				
3.	TEMPERATURE: A	bient				
4.	COLLECTION MEDI	UM: Charcoal				
5.	COLLECTION SYST	EM: Charcoal				
6.	OTHER CONDITION	S: linch cells	were use	d.		
7.	DEVIATIONS FROM	ASTM F739 METHOD	:			
CH	HALLENGE CHEMICAL	1	: C	OMPONENT 2	:	3
	CHEM NAME (8) :		:	N/A	:	TI/A
	CAS NUMBER(s):		:	N/A	<sup>:</sup>	N/A
	CONC. (IF MIX) CHEMICAL SOURCE		<u>:</u>	N/A		N/A
4. TE	ST RESULTS	FIBRET	'	N/A	·	N/A
_						
	DATE TESTED: 5-			<del></del>		
	NUMBER OF SAMPLE BREAKTHROUGH TIM					
	MIN DETECTABLE I					
		MEATION RATE N/A				<del></del>
	SAMPLE THICKNESS					
7.		INTS Cells 1,2, &	3 at end	of three hou	r test	
	TIME	: CONCENTRATI	ion :	CONCENTRATIO	N: C	ONCENTRATION
	1. 3 hours	: <0.5 ppm	:	<0.5 ppm	:	<0.5 ppm
	2.	:			:	
	3.	:	:		:	
	4.	:	<u>:</u>	·	:	
	5.	:	<u>:</u>			
	6	<u>:</u>	:		:	
	7.	<u>:</u>	<u> </u>		:	
	8.	<del>:</del>		·	:	
	9.	<u>:</u>	<u> </u>	···	:	
	10.	:	:			

Samples were run by Denise McDonald and Kevin Selby on May 13, 1987.

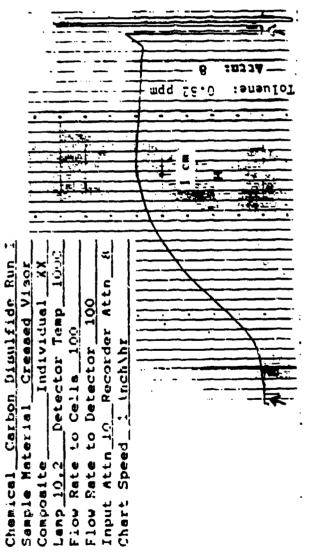
SOURCE OF DATA

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1.	DESCRIPTION OF PRODUCT EVALUATED			
	1: TYPE: Teflon			
	2: PROTECTIVE MATERIAL CODE: 09			
	3: CONDITION BEFORE TEST: Unused, no v	isible imperfection	กร	
	4: MANUFACTURER: Dupont			
	5: PRODUCT IDENTIFICATION: Visor			
	6: LOT OR MANUFACTURER DATE: N/A			
	7: NOMINAL THICKNESS: 11-13 mil			
	8: DESCRIPTION: Material was a white t			was creased using
	CHEMFAB Fold Resistance Test procedu	re of 5 September	1986.	
2.	TEST METHOD			
	1. TESTING LABORATORY: Texas Research I	needeura 9063 Baa	Canac	Pood Augstan TY
	2. ANALYTICAL METHOD: Continuous photo			
	3. TEMPERATURE: 22-25 °C	TOUTZECTON GECECT	OH WALL	a louis ev lemp.
	4. COLLECTION MEDIUM: N2	- <del></del>		
	5. COLLECTION SYSTEM: N2			<del></del>
	6. OTHER CONDITIONS: 1 inch cell was	used. /Detector Ter	Deretur	• = 100C.
	7. DEVIATIONS FROM ASIM F739 HETHOD: F	low rate to cell a	100	cc/min.
	a			
3.	CHALLENGE CHEMICAL 1	: COMPONENT 2	:	3
	1. CHEM NAME(s): Carbon Disulfide	: N/A	•	¥/A
	2. CAS NUMBER(s): 75-15-0	: N/A		N/A
	3. CONC. (IF MIX) N/A	: N/A	;	N/A
	4. CHEMICAL SOURCE: Mallinckrodt	: N/A		N/A
	1. DATE TESTED: 4-8-87 2. NUMBER OF SAMPLES TESTED: One (Run I 3. BREAKTHROUGH TIME: 34 minutes 4. MIN DETECTABLE LIMIT .09 ppm 5. STEADY STATE PERMEATION RATE 8.40 (6. SAMPLE THICKNESS: 12 mils	) ug/cm2*hr)		
	7. SELECTED DATA POINTS N/A	<del></del>	<del></del>	
	7. SELECTED DATA POINTS N/A	<del></del>		
	TIME : CONCENTRATION	: CONCENTRATIO	) : NC	CONCENTRATION
	2.	:		
	3.	:	-:	
	4.	:	:	
	5. :	•		
	6. :	:	:	619
	7. :	:	:	
	8. :		:	
	9.		:	
	10	:	:	
	8. OTHER OBSERVATIONS:			
•				
5.	SOURCE OF DATA	d on Annel 9 100	7	
	Sample was run by Denise McDonal	O OH APTIL 0, 190	<del>/ •</del>	

Chemical Resistance Testing of Creased Visor Material

## Carbon Disulfide Run



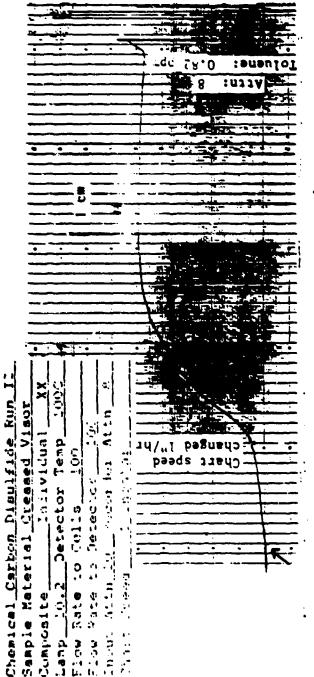
Carbon Disuffide charged into cells

Switched from cells to standard gas

•	DESCRIPTION OF PRODUCT EVALUATED			
	1: TYPE: Teflen			
	2: PROTECTIVE MATERIAL CODE: 09			
	3: CONDITION BEFORE TEST: Unused, no	visible imperfection	ns	
	4: MANUFACTURER: Dupont			
	5: PRODUCT IDENTIFICATION: Visor			
	6: LOT OR MANUFACTURER DATE: N/A			
	7: NOMINAL THICKNESS: 11-13 mil			
	8: DESCRIPTION: Material was a white			was creased using
	CHEMFAE Fold Resistance Test proce	dure or 3 September	1900.	
	TEST METHOD			
	1. TESTING LABORATORY: Texas Research	Institute, 9063 Bee	Caves	Road, Austin, TX
	2. ANALYTICAL METHOD: Continuous pho	toionization detecti	ion with	a 10.20 eV lamp.
	3. TEMPERATURE: 22-25°C			
	4. COLLECTION MEDIUM: No			
	5. COLLECTION SYSTEM: N2			
	6. OTHER CONDITIONS: 1 inch cell wa			
	7. DEVIATIONS FROM ASIM F739 METHOD:	Flow rate to cell e	ras 100	cc/min.
L	CHALLENGE CHEMICAL 1	: COMPONENT 2	:	3
	1. CHEM NAME(s): Carbon Disulfide	: N/A	:	N/A
	2. CAS NUMBER(s): 75-15-0	· B/A		N/A
	3. CONC. (IF MIX) N/A	: N/A	;	N/A
	4. CHEMICAL SOURCE: Mallinckrodt	: N/A		N/A
١.	TEST RESULTS			
	1. DATE TESTED: 4-9-87			
	2. NUMBER OF SAMPLES TESTED: One (Ru	in II)		
	3. BREAKTHROUGH TIME: 25 minutes			
	4. MIN DETECTABLE LIMIT . 10 ppm			
	5. STEADY STATE PERMEATION RATE 8.60	(ug/cm2*hr)		
	6. SAMPLE THICKNESS: 12 mile			
	7. SELECTED DATA POINTS N/A			· · · · · · · · · · · · · · · · · · ·
	TIME : CONCENTRATIO	ON : CONCENTRATIO	ON :	CONCENTRATION
	2:	:		
	3.			
	4. 5.	:	<del></del>	<del> </del>
	6.	:	<del></del>	<del></del>
	7,	:		
	8	<u>:</u>	:	
	9. <u>:</u> 10. :	<del></del>	<del>:</del>	
	10		<del></del>	
•	8. OTHER OBSERVATIONS:			

Chemical Resistance Testing of Creased Visor Material

## Carbon Disulfide Run II



Carbon Disuitide charged into cells

Dwitched from cells to standard gas

	F2CKILITON OF LK			
1:	: TYPE: Teflon			
2:		TERIAL CODE: 09		
3:			visible imperfections	
4:				<del></del>
5:		IFICATION: Visor		· · · · · · · · · · · · · · · · · · ·
6:		CTURER DATE: N/A		
7:		NESS: 11-13 =11	<del></del>	
8:			transparent sheet. Sam	nle was creased usin
ο.	CHEMEAR EVIA	Resistance Test proce	edure of 5 September 198	6.
	Cheman Fold	Resistance lest proci	eddie of 3 deptember 170	
TE	EST METHOD			
1.			h Institute, 9063 Bee Ca	
2.	. ANALYTICAL ME	THOD: Continuous pho	otoionization detection	with a 10.20 eV lamp
3.	. TEMPERATURE:	22-25°C		
4.	. COLLECTION ME	DIUM: N2		
5,	. COLLECTION SY	STEM: No		
			as used. Detector Temper	ature = 100C.
			Flow rate to cell was	
CF	HALLENGE CHEMICA	NL 1	: COMPONENT 2	: 3
				. 97.44
		: Carbon Disulfide	: W/A	:
	. CAS NUMBER(s)		: N/A	: N/A
3.	. CONC. (IF MIX			: N/A
4.	. CHEMICAL SOUR	CE:Mallinckrodt	: N/A	:N/A
2. 3. 4. 5.	. MIN DETECTABLE	PLES TESTED: One (RIME: 34 minutes LIMIT .10 ppm PERMEATION RATE 12.8 ESS: 12 mils	un 111) O(ug/cm2*hr)	
	TIME	: CONCENTRATI	ON : CONCENTRATION	: CONCENTRATION
	1 -			<del>`</del>
	1	:	:	•
	2.	<u>:</u>	<del></del>	<u>:</u>
	2.		:	:
	2. 3. 4.		:	<u>:</u> :
	2. 3. 4. 5.		:	: : :
	2. 3. 4. 5. 6.	:		: : :
	2. 3. 4. 5. 6.		:	: : : :
	2	:		: : : :
	2		:	: : : :
	2			
8.	2	:		: : : : : :
. 8.	2			: : : : : :
. 8.	2	:		
•	2. 3. 4. 5. 6. 7. 8. 9. 10. OTHER OBSERVAT	: : : : : : : : : : : :		

# Chemical Resistance Testing of Creased Visor Material

## Carbon Disulfide Run III

Chemical Carbon Disulfide Run III Sample Material Creeged Visor

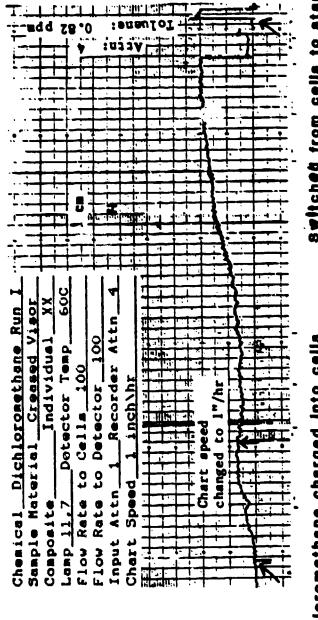
Individuel



1.	DE:	SCRIPTION OF P	RODUCT E	VALUATED			
	1:	TYPE: Teflon					
	2:	PROTECTIVE H		CODE: 09			
	3:	CONDITION BE	FORE TEST	I: Unused, no	visible imperfect	ions	
	4:	<b>MANUFACTURER</b>					
	5:	PRODUCT IDEN					
	6:	# T T T T T T T T T T T T T T T T T T T					
	7:	NOMINAL THIC					
	8:	DESCRIPTION:	Materia	l was a white	transparent sheet	Sample	was creased using
		CHEMPAB Fold	Resistan	nce Test proced	ure of 5 September	r 1986.	
2.	TES	ST METHOD					
	1.	TESTING LABOR	RATORY:	Texas Research	Institute, 9063 B	ee Caves	Road, Austin, TX
	2.	ANALYTICAL M	ETHOD:	Continuous phot	cionization detec	tion wit	n a 11.70 eV lamp.
	3.						
	4.						
	5.		YSTEM: 1	N2			
		OTHER CONDIT	IONS:	l inch cell was	used./Detector To	emperatu	re = 60C.
	7.	DEVIATIONS F	ROM ASTM	F739 METHOD:	flow rate to cell	was 100	cc/min.
3.	CIL	LLENGE CHEMIC	AT.	1	: COMPONENT 2	8	3
	1	CHEM NAME(s)	. D/ - L :	lamamakkana	: : N/A	•	N/A
		CAS NUMBER(s)			N/A		N/A
		CONC. (IF MI		<u> </u>	N/A	:	N/A
	4.	CHEMICAL SOU			N/A	:	N/A
•	1. 2. 3.	T RESULTS  DATE TESTED:  NUMBER OF SAM  BREAKTHROUGH:  MIN DETECTABLE	PLES TEST	TED: One (Ru	n 1)		
		STEADY STATE			(ug/cm²*hr)		
		SAMPLE THICKN			(UE/CH-HIL/	<del></del>	
		SELECTED DATA					····
		TIME	:	CONCENTRATION	: CONCENTRAT	ION :	CONCENTRATION
		2.	<u>:</u>		<del></del>		
-		3.	<del></del>		<del> </del>		
			<del></del>		_ <del></del>	<del></del>	<del></del>
		<b>4.</b>	<del>- : -</del>	<del></del>	<del></del>	<del></del>	
		6.	— <del>:</del> -		<del></del>		
		ÿ: ——	<del>:</del>	<del></del>		<del></del> -	
		8.	<del></del>		<del></del>	<del>:-</del>	
		9.	<del></del>		<del></del>	<del></del> ;	
		10.	-:	<del></del>		<del></del>	
	R.	OTHER OBSERVAT	PTONS ·				
		VOUDRING					
_							
5.	SOU	RCE OF DATA Sample wa	is run hy	Denise McDone	ld on April 15, 1	987.	
						- <del></del>	

Chemical Resistance Testing of Creased Visor

## Dichloromethane Run



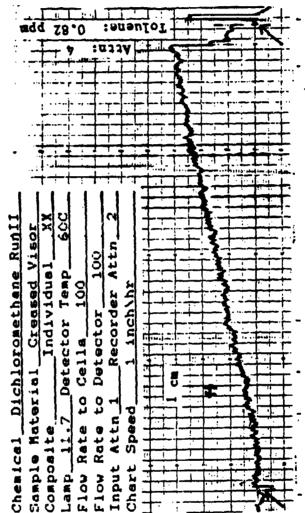
Dichloromethane charged into cells

Switched from cells to standard gas

1 .					
1:	TYPE: Teflon				<del>- :</del>
2:	PROTECTIVE M	IATERIAL CODE: 09			
3:	CONDITION BE	FORE TEST: Unus	ed, no visible	e imperfections	
4:	MANUFACTURER	: Dupont		_	
5:	PRODUCT IDEN	TIFICATION: Vis	) r		
6:	LOT OR MANUF	ACTURER DATE: N/	1		
7:	ROMINAL THIC	KNESS: 11-13 mil			
8:			white transp	arent sheet. Same	le was creased us
•	C"EMFAB Fold	Resistance Test	procedure of	5 September 1986	
TES	ET KETHOD				
1.					ves Road, Austin,
2.	ANALYTICAL N	ETHOD: Continuo	s photoioniz	ation detection v	with a 11.70 eV la
3.	TEMPERATURE:	22-25°C			<del></del>
4.	COLLECTION M	EDIUM: No		<del></del>	
5.	COLLECTION S				
6.			ll was used.	Delector Tempera	sture = 60C.
7.		ROM ASTM F739 ME			
CHA	LLENGE CHEMIC	AL 1	: C	OMPONENT 2	3
1.	CHEM NAME(s)	: Dichlorometh	ene :	N/A	N/A
2.	CAS NUMBER(	75-09-2		N/A	N/A
	CONC. (IF MI			N/A	N/A
4.	CHEMICAL SOU	·	:	N/A	N/A
1.	T RESULTS  DATE TESTED:				
		PLES TESTED: 0		· · · · · · · · · · · · · · · · · · ·	
3.	BREAKTHROUGH	TIME: 60 minutes	<u> </u>		·
4.	MIN DETECTABL	E LIMIT .06 pp	Δ		
		PERMEATION RATE	2.45 (ug/cm	2*hr)	
		ESS: 12 mils			
7.	SELECTED DATA	POINTS N/A			
	TIME	: CONCENT	TRATION :	CONCENTRATION	: CONCENTRATION
	2.	<del></del>	<u>.</u>		•
		:	<del></del>		<del></del>
	3.	<u>•</u>		<del></del>	<u>.                                    </u>
	3.	•			•
	4.		<del></del>		•
	4	:	<u> </u>		:
	4. 5. 6.		:		
	4	:			
	4. 5. 6. 7. 8.		:		
	4. 5. 6. 7. 8. 9.	:			
	4. 5. 6. 7. 8.	:			
	4. 5. 6. 7. 8. 9.				
	4. 5. 6. 7. 8. 9. 10.				
8. (	4. 5. 6. 7. 8. 9. 10.				

# Chemical Resistance Testing of Creased Visor

## Dichloromethane Run II



Dichloromethane charged into cells

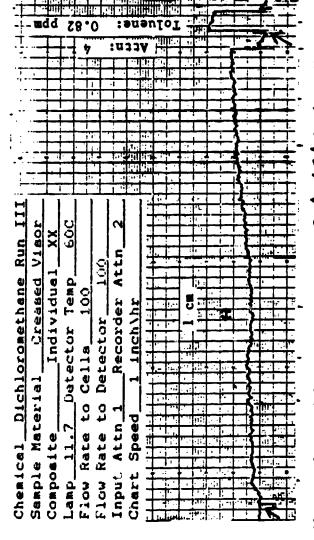
**Ewitched** from cells to standard gas

1. DESCRIPTION OF PRODUCT EVALUATED

	2: PROTECTIVE M	ATERIAL COL	DE: 09				
				visib	le imperfection	ns	
	4: MANUFACTURER						<del></del>
	5: PRODUCT IDEN		Visor				* N.S
	6: LOT OR MANUF						<del></del>
	7: NOMINAL THIC	KNESS: 11-1	13 mil		<del></del>		
	8: DESCRIPTION:			trans	parent sheet.	Sample	was creased usin
	CHEMFAB Fold	Resistance	Test proce	iure o	f 5 September	1986.	
•	TEST METHOD						
		RATORY: Tex	kas Research	Insti	tute, 9063 Bee	Caves	Road, Austin, TX
	2. ANALYTICAL M		ntinuous pho	toioni	zation detecti	on wit	h a 11.70 eV lamp
	3. TEMPERATURE:				<del></del>		
	4. COLLECTION M						
	5. COLLECTION S						
	6. OTHER CONDIT	IONS: 1 1	inch cell was	used	./Detector Tem	peratu	re = 50C.
	7. DEVIATIONS F	ROM ASTM F7	739 METHOD: _	Flow	rate to cell w	as 100	cc/min.
•	CHALLENGE CHEMIC	AL	2	<b>a</b> .(	COMPONENT 2	•	3
	1. CHEM NAME(s)			_:	N/A	:_	N/A
	2. CAS NUMBER(s			_:	N/A	:_	N/A
	3. CONC. (IF MI			_:	N/A	:	N/A
	4. CHEMICAL SOU	RCE: Fisher		<b>:</b>	N/A	:_	N/A
•	TEST RESULTS						
•	1. DATE TESTED: 4 2. NUMBER OF SAM 3. BREAKTHROUGH 3 4. MIN DETECTABLE 5. STEADY STATE 6 6. SAMPLE THICKNE	PLES TESTED TIME: 30 m E LIMIT .08 PERMEATION	inutes ppm RATE 3.55	111) (ug/c	n <sup>2</sup> *hr)		
•	1. DATE TESTED: 4 2. NUMBER OF SAM 3. BREAKTHROUGH 3 4. MIN DETECTABL 5. STEADY STATE 1	PLES TESTED TIME: 30 m E LIMIT .08 PERMEATION ESS: 12 mi	ppm RATE 3.55		m <sup>2</sup> *hr)		
	1. DATE TESTED: 4 2. NUMBER OF SAM 3. BREAKTHROUGH : 4. MIN DETECTABLE 5. STEADY STATE : 6. SAMPLE THICKNE	PLES TESTED TIME: 30 m E LIMIT .08 PERMEATION ESS: 12 mi POINTS N/	ppm RATE 3.55	(ug/cı	m <sup>2</sup> *hr) CONCENTRATIO	N :	CONCENTRATION
•	1. DATE TESTED: 4. NUMBER OF SAMI 3. BREAKTHROUGH : 4. MIN DETECTABLE 5. STEADY STATE : 6. SAMPLE THICKNE 7. SELECTED DATA  TIME	PLES TESTED TIME: 30 m E LIMIT .08 PERMEATION ESS: 12 mi POINTS N/	inutes 3 ppm RATE 3.55	(ug/cı		N :	CONCENTRATION
	1. DATE TESTED: 4 2. NUMBER OF SAM 3. BREAKTHROUGH 3 4. MIN DETECTABLE 5. STEADY STATE 1 6. SAMPLE THICKNE 7. SELECTED DATA  TIME 1. 2.	PLES TESTED TIME: 30 m E LIMIT .08 PERMEATION ESS: 12 mi POINTS N/ : C	inutes 3 ppm RATE 3.55	(ug/cı		N :	CONCENTRATION
	1. DATE TESTED: 4 2. NUMBER OF SAM 3. BREAKTHROUGH 1 4. MIN DETECTABLE 5. STEADY STATE 1 6. SAMPLE THICKNE 7. SELECTED DATA  TIME 1. 2.	PLES TESTED TIME: 30 m E LIMIT .08 PERMEATION ESS: 12 mi POINTS N/ : C	inutes 3 ppm RATE 3.55	(ug/cı		N :	CONCENTRATION
	1. DATE TESTED: 4 2. NUMBER OF SAMI 3. BREAKTHROUGH 3 4. MIN DETECTABLE 5. STEADY STATE 1 6. SAMPLE THICKNE 7. SELECTED DATA  TIME 1. 2. 3.	PLES TESTED TIME: 30 m E LIMIT .08 PERMEATION ESS: 12 mi POINTS N/ : C	inutes 3 ppm RATE 3.55	(ug/cı		N :	CONCENTRATION
	1. DATE TESTED: 2. NUMBER OF SAMI 3. BREAKTHROUGH 3. MIN DETECTABLE 5. STEADY STATE 16. SAMPLE THICKNE 7. SELECTED DATA  TIME 1. 2. 3. 4. 5.	PLES TESTED TIME: 30 m E LIMIT .08 PERMEATION ESS: 12 mi POINTS N/ : C : :	inutes 3 ppm RATE 3.55	(ug/cı		N : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	1. DATE TESTED: 4. NUMBER OF SAMI 3. BREAKTHROUGH ? 4. MIN DETECTABLE 5. STEADY STATE ! 6. SAMPLE THICKNE 7. SELECTED DATA  TIME 1. 2. 3. 4. 5. 6.	PLES TESTED TIME: 30 m E LIMIT .08 PERMEATION ESS: 12 mi POINTS N/ : C : : : :	inutes 3 ppm RATE 3.55	(ug/cı		N : : : : : : : : : : : : : : : : : : :	<b>CONCENTRATION</b>
	1. DATE TESTED: 4. NUMBER OF SAMI 3. BREAKTHROUGH 1. MIN DETECTABLE 5. STEADY STATE 1. 6. SAMPLE THICKNE 7. SELECTED DATA  TIME 1. 2. 3. 4. 5. 6. 6.	PLES TESTED TIME: 30 m E LIMIT .08 PERMEATION ESS: 12 mi POINTS N/ : C : : : :	inutes 3 ppm RATE 3.55	(ug/cı		N : : : : : : : : : : : : : : : : : : :	©NCENTRATION
	1. DATE TESTED: 4. NUMBER OF SAMI 3. BREAKTHROUGH ? 4. MIN DETECTABLE 5. STEADY STATE I 6. SAMPLE THICKNE 7. SELECTED DATA  TIME 1. 2. 3. 4. 5. 6. 7.	PLES TESTED TIME: 30 m E LIMIT .08 PERMEATION ESS: 12 mi POINTS N/ : C : : : :	inutes 3 ppm RATE 3.55	(ug/c)		N :	CONCENTRATION
•	1. DATE TESTED: 4. 2. NUMBER OF SAMI 3. BREAKTHROUGH 3. 4. MIN DETECTABLE 5. STEADY STATE 16. SAMPLE THICKNE 7. SELECTED DATA  TIME 1. 2. 3. 4. 5. 6. 7. 8.	PLES TESTEL TIME: 30 m E LIMIT .08 PERMEATION ESS: 12 mi POINTS N/ : C : : : : : :	inutes 3 ppm RATE 3.55	(ug/c)		N :	CONCENTRATION
	1. DATE TESTED: 4 2. NUMBER OF SAMI 3. BREAKTHROUGH 3 4. MIN DETECTABLE 5. STEADY STATE 1 6. SAMPLE THICKNE 7. SELECTED DATA  TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	PLES TESTEL TIME: 30 m E LIMIT .08 PERMEATION ESS: 12 mi POINTS N/ : C : : : : : : : : : : : : : : : : : :	ninutes ppm RATE 3.55 1s A CONCENTRATION	(ug/c)		N : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	1. DATE TESTED: 4 2. NUMBER OF SAMI 3. BREAKTHROUGH 3 4. MIN DETECTABLE 5. STEADY STATE 1 6. SAMPLE THICKNE 7. SELECTED DATA  TIME 1. 2. 3. 4. 5. 6. 7. 8. 9.	PLES TESTEL TIME: 30 m E LIMIT .08 PERMEATION ESS: 12 mi POINTS N/ : C : : : : : : : : : : : : : : : : : :	ninutes ppm RATE 3.55 1s A CONCENTRATION	(ug/c)		N : : : : : : : : : : : : : : : : : : :	CONCENTRATION
	1. DATE TESTED: 4 2. NUMBER OF SAMI 3. BREAKTHROUGH 3 4. MIN DETECTABLE 5. STEADY STATE 1 6. SAMPLE THICKNE 7. SELECTED DATA  TIME 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	PLES TESTEL TIME: 30 m E LIMIT .08 PERMEATION ESS: 12 mi POINTS N/ : C : : : : : : : : : : : : : : : : : :	ninutes ppm RATE 3.55 1s A CONCENTRATION	(ug/c)		N : : : : : : : : : : : : : : : : : : :	CONCENTRATION

Chemical Resistance Testing of Creased Visor

## Dichloromethane Run III



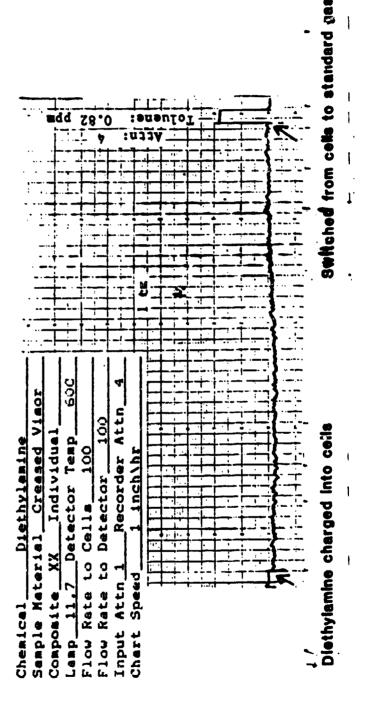
Dichloromethanc charged into cells

Switched from cells to standard gas

1: TYPE: Teflon 2: PROTECTIVE MATERIAL CODE: 09 3: CONDITION BEFORE TEST: Unused, no visible imperfections	
3: CONDITION BEFORE TEST: Unused, no visible imperfections	
3: CONDITION BEFORE TEST: Unused, no visible imperfections	
4. MANUFACTURED Disease	
4: MANUFACTURER: Dupont	
5: PRODUCT IDENTIFICATION: Visor	
6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 11-13 mil	
8: DESCRIPTION: Material was a white transparent sheet. Sample was	s creased usin
CHEMFAB Fold Resistance Test procedure of 5 September 1986.	
TEST METHOD	
1. TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Ro	ad, Austin, TX
2. ANALYTICAL METHOD: Continuous photoionization detection with a	11.70 eV lamp
3. TEMPERATURE: 22-25°C	
4. COLLECTION MEDIUM: N2	
5. COLLECTION SYSTEM: N2	
6. OTHER CONDITIONS: 1 inch cells were used. Detector Temperatur	e = 60C.
7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate to cells were 100	cc/min.
CHALLENGE CHEMICAL 1 : CONFORENT 2 :	3
1. CHEM NAME(s): Diethylamine : N/A :	N/A
2. CAS NUMBER(s): 109-89-7 : N/A :	N/A
3. CONC. (IF MIX) N/A : N/A :	N/A
4. CHEMICAL SOURCE: EM Science : N/A :	N/A
	i.
1. DATE TESTED: 4-23-87  2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 17.8 hou  4. MIN DETECTABLE LIMIT 1.21 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 12 mils  7. SELECTED DATA POINTS N/A	•.
2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 17.8 hou  4. MIN DETECTABLE LIMIT 1.21 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 12 mils  7. SELECTED DATA POINTS N/A	•.
2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 17.8 hou  4. MIN DETECTABLE LIMIT 1.21 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 12 mils  7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CO  1. : : : : : : : : : : : : : : : : : : :	rs.
2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 17.8 hou  4. MIN DETECTABLE LIMIT 1.21 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 12 mils  7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CO  1. : : : : : : : : : : : : : : : : : : :	rs.
2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 17.8 hou  4. MIN DETECTABLE LIMIT 1.21 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 12 mils  7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION	rs.
2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 17.8 hou  4. MIN DETECTABLE LIMIT 1.21 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 12 mils  7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CO  1. : : : : : : : : : : : : : : : : : : :	rs.
2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 17.8 hou  4. MIN DETECTABLE LIMIT 1.21 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 12 mils  7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CO  1. : : : : : : : : : : : : : : : : : : :	rs.
2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 17.8 hou  4. MIN DETECTABLE LIMIT 1.21 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 12 mils  7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CO  1. : : : : : : : : : : : : : : : : : : :	rs.
2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 17.8 hou  4. MIN DETECTABLE LIMIT 1.21 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 12 mils  7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CO  1. : : : : : : : : : : : : : : : : : : :	rs.
2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 17.8 hou  4. MIN DETECTABLE LIMIT 1.21 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 12 mils  7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CO  1. : : : : : : : : : : : : : : : : : : :	rs.
2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 17.8 hou  4. MIN DETECTABLE LIMIT 1.21 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 12 mils  7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CO  1. : : : : : : : : : : : : : : : : : : :	rs.
2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 17.8 hou  4. MIN DETECTABLE LIMIT 1.21 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 12 mils  7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CO  1. : : : : : : : : : : : : : : : : : : :	rs.
2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 17.8 hou  4. MIN DETECTABLE LIMIT 1.21 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 12 mils  7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CO  1. : : : : : : : : : : : : : : : : : : :	rs.
2. NUMBER OF SAMPLES TESTED: Three  3. BREAKTHROUGH TIME: No breakthrough was observed after 17.8 hou  4. MIN DETECTABLE LIMIT 1.21 ppm  5. STEADY STATE PERMEATION RATE N/A  6. SAMPLE THICKNESS: 12 mils  7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CO  1. : : : : : : : : : : : : : : : : : : :	rs.

# Chemical Resistance Testing of Creased Visor

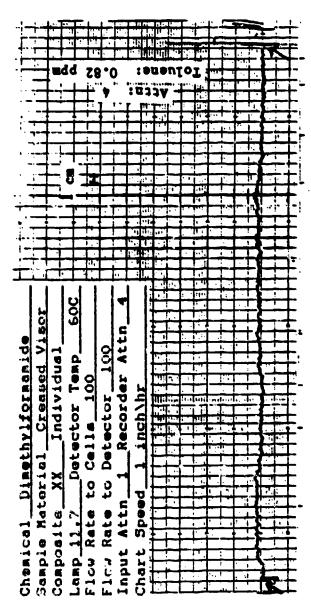
## Diethylamine



1:						
2:	PROTECTIVE P	MATERIAL	CODE: 09			
3:				visible imperfection	ns	
4:						
اد						<del></del>
6:						
7:					Comple	
8:	C'IEMFAB Fold	Resist	ance Test proced	ransparent sheet. are of 5 September	1986.	. As Cleased as
T	EST METHOD					
1.	TESTING LABO	ORATORY:	Texas Research	Institute, 9063 Bed	Cave	Road, Austin,
2.				pionization detect:	lon wit	h a 11.70 eV la
3.	TEMPERATURE:	: 22-25°	Ċ			
4.	COLLECTION P	MEDIUM:	N <sub>2</sub>			
5.			N <sub>2</sub>			
6.				re used./Detector		
7.	DEVIATIONS 1	FROM AST	F739 METHOD:	flow rate to cells	Were	100 cc/min.
C	IALIENCE CHEMIC	CAL	1	: COMPONENT 2	:	.3
1.	CREM NAME (a)	) - Dim	ethylformamide	: N/A	•	N/A
	CAS WUMBER(	N: 68-	12-2	: N/A	;	N/A
	CONC. (IF M			: N/A	:-	N/A
4.	CHEMICAL SOL	RCE:Hal		: N/A		N/A
1. 2. 3. 4. 5.	CHEMICAL SON ST RESULTS  DATE TESTED: NUMBER OF SAN BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN	4-24-8  MPLES TE: TIME: No LE LIMIT PERMEAT NESS: 1	7 STED: Three 0 breakthrough wat 1.16 ppm ION RATE N/A 2 mils			N/A
1. 2. 3. 4. 5.	CHEMICAL SON ST RESULTS  DATE TESTED: NUMBER OF SAN BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA	4-24-8 MPLES TES TIME: No LE LIMIT PERMEAT VESS: 1: A POINTS	Three  b breakthrough wa  1.16 ppm  ION RATE N/A  2 mils  N/A	: N/A as observed after	20.3 h	N/A ours.
1. 2. 3. 4. 5.	CHEMICAL SON ST RESULTS  DATE TESTED: NUMBER OF SAN BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICKN SELECTED DATA  TIME	4-24-8  MPLES TE: TIME: No LE LIMIT PERMEAT NESS: 1	7 STED: Three 0 breakthrough wat 1.16 ppm ION RATE N/A 2 mils	: N/A	20.3 h	N/A
1. 2. 3. 4. 5.	CHEMICAL SON CST RESULTS  DATE TESTED: NUMBER OF SAN BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA  TIME 1.	4-24-8 MPLES TES TIME: No LE LIMIT PERMEAT VESS: 1: A POINTS	Three  b breakthrough wa  1.16 ppm  ION RATE N/A  2 mils  N/A	: N/A as observed after	20.3 h	N/A ours.
1. 2. 3. 4. 5.	CHEMICAL SON  ST RESULTS  DATE TESTED: NUMBER OF SAN BREAKTHROUGH MIN DETECTABLE STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2.	4-24-8 MPLES TES TIME: No LE LIMIT PERMEAT VESS: 1: A POINTS	Three  b breakthrough wa  1.16 ppm  ION RATE N/A  2 mils  N/A	: N/A as observed after	20.3 h	N/A ours.
1. 2. 3. 4. 5.	CHEMICAL SON  ST RESULTS  DATE TESTED: NUMBER OF SAN BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3.	4-24-8 MPLES TES TIME: No LE LIMIT PERMEAT VESS: 1: A POINTS	Three  b breakthrough wa  1.16 ppm  ION RATE N/A  2 mils  N/A	: N/A as observed after	20.3 h	N/A ours.
1. 2. 3. 4. 5.	CHEMICAL SON EST RESULTS  DATE TESTED: NUMBER OF SAN BREAKTHROUGH MIN DETECTABLE STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4.	4-24-8 MPLES TES TIME: No LE LIMIT PERMEAT VESS: 1: A POINTS	Three  b breakthrough wa  1.16 ppm  ION RATE N/A  2 mils  N/A	: N/A as observed after	20.3 h	N/A ours.
1. 2. 3. 4. 5.	CHEMICAL SON CST RESULTS  DATE TESTED: NUMBER OF SAN BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5.	4-24-8 MPLES TES TIME: No LE LIMIT PERMEAT VESS: 1: A POINTS	Three  b breakthrough wa  1.16 ppm  ION RATE N/A  2 mils  N/A	: N/A as observed after	20.3 h	N/A ours.
1. 2. 3. 4. 5.	CHEMICAL SON  ST RESULTS  DATE TESTED: NUMBER OF SAN BREAKTHROUGH MIN DETECTABLE STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6.	4-24-8  MPLES TE: TIME: No LE LIMIT PERMEAT VESS: 1: A POINTS : :	Three  b breakthrough wa  1.16 ppm  ION RATE N/A  2 mils  N/A	: N/A as observed after	20.3 h	N/A ours.
1. 2. 3. 4. 5.	CHEMICAL SON  ST RESULTS  DATE TESTED: NUMBER OF SAN BREAKTHROUGH MIN DETECTABLE STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7.	4-24-8  MPLES TE: TIME: No LE LIMIT PERMEAT NESS: 13 A POINTS	Three  b breakthrough wa  1.16 ppm  ION RATE N/A  2 mils  N/A	: N/A as observed after	20.3 h	N/A ours.
1. 2. 3. 4. 5.	CHEMICAL SON EST RESULTS  DATE TESTED: NUMBER OF SAN BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8.	4-24-8 MPLES TE: TIME: N: LE LIMIT PERMEAT: NESS: 1: A POINTS : : : : :	Three  b breakthrough wa  1.16 ppm  ION RATE N/A  2 mils  N/A	: N/A as observed after	20.3 h	N/A ours.
1. 2. 3. 4. 5.	CHEMICAL SON  ST RESULTS  DATE TESTED: NUMBER OF SAN BREAKTHROUGH MIN DETECTABLE STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7.	4-24-8 MPLES TE: TIME: N: LE LIMIT PERMEAT: NESS: 1: A POINTS : : : : :	Three  b breakthrough wa  1.16 ppm  ION RATE N/A  2 mils  N/A	: N/A as observed after	20.3 h	N/A ours.
4. TE 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SON EST RESULTS  DATE TESTED: NUMBER OF SAN BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	4-24-8 MPLES TE: TIME: No LE LIMIT PERMEAT: NESS: 1: A POINTS : : : : : : : : : : : : : : : : : : :	Three  b breakthrough wa  1.16 ppm  ION RATE N/A  2 mils  N/A	: N/A as observed after	20.3 h	N/A ours.
4. TE 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SON EST RESULTS  DATE TESTED: NUMBER OF SAN BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	4-24-8 MPLES TE: TIME: No LE LIMIT PERMEAT: NESS: 1: A POINTS : : : : : : : : : : : : : : : : : : :	Three  b breakthrough wa  1.16 ppm  ION RATE N/A  2 mils  N/A	: N/A as observed after	20.3 h	N/A ours.
4. TE 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SON EST RESULTS  DATE TESTED: NUMBER OF SAN BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	4-24-8 MPLES TE: TIME: No LE LIMIT PERMEAT: NESS: 1: A POINTS : : : : : : : : : : : : : : : : : : :	Three  b breakthrough wa  1.16 ppm  ION RATE N/A  2 mils  N/A	: N/A as observed after	20.3 h	N/A ours.

# Chemical Resistance Testing of Creased Visor

Dimethylformamide



Dimethylformamide charged into celia

Switched from cells to standard gas

	1: TYPE: Teflon 2: PROTECTIVE MATERIAL CODE: 09							
	3: CONDITION BEFORE TEST: Unused, no visible imperfections							
	4: MANUFACTURER: D		Tote seperied From					
	5: PRODUCT IDENTIFI							
	6: LOT OR MANUFACTU							
	7: NOMINAL THICKNES							
			insparent sheet. Sai	mple was creased using				
		istance Test procedure						
2.	TEST METHOD							
				eves Road, Austin, TX				
			nization detection	with a 10.20 eV lamp.				
	3. TEMPERATURE: 22- 4. COLLECTION MEDIU			<del></del>				
	4. COLLECTION MEDIU 5. COLLECTION SYSTE		<del></del>					
		: 1 inch cells were	used. /Derector Ton	perature = 100C.				
	7. DEVIATIONS FROM	ASTM F739 METHOD: F1	ow rate to cells we	re 100 cc/min.				
3.	CHALLENGE CHEMICAL	1 :	CONFORENT 2	3				
	1. CHEM NAME (s) :		N/A	:N/A				
	- ·	141-78-6 :	¥/A	: N/A				
	3. CONC. (IF MIX)		N/A	:N/A				
	4. CHEMICAL SOURCE:	EM Science :	N/A	: N/A				
	J. BREAKTHROUGH TIME							
	3. BREAKTHROUGH TIME 4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME 1. 2. 3. 4. 5.	EATION RATE N/A 12 mils	: CONCENTRATION	: CONCENTRATION : :				
	4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME: 1. :: 2. ::	EATION RATE N/A 12 mils NTS N/A	: CONCENTRATION : :	: CONCENTRATION : : :				
	4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME: 1. :: 2. ::	EATION RATE N/A 12 mils NTS N/A	: CONCENTRATION :	: CONCENTRATION : : : : : : :				
	4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME: 1	EATION RATE N/A 12 mils NTS N/A	: CONCENTRATION	: CONCENTRATION : : : : :				
	4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME 1	EATION RATE N/A 12 mils NTS N/A	: CONCENTRATION :	: CONCENTRATION : : : : : : :				
	4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME 1	EATION RATE N/A  12 mils  NTS N/A  CONCENTRATION	: CONCENTRATION :	: CONCENTRATION : : : : : : : : :				
	4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME 1	EATION RATE N/A  12 mils  NTS N/A  CONCENTRATION	: CONCENTRATION :	: CONCENTRATION : : : : : : : : : : : : : : : : : : :				
5.	4. MIN DETECTABLE LI 5. STEADY STATE PERM 6. SAMPLE THICKNESS: 7. SELECTED DATA POI  TIME 1	EATION RATE N/A  12 mils  NTS N/A  CONCENTRATION						

Dwitched from cells to standard gas

# Chemical Resistance Testing of Creased Visor Marerial

KASSAN SAMES KREEN

## Ethyl Acetate

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6 :n3:	人 : 李台 提 (面 探) [1]
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The second secon	
Creased Visor Individual Individu	
A CLUB SEE SEE SEE SEE SEE SEE SEE SEE SEE SE	
radioces in the control of the contr	
- 비행   -	
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ં ભૂકોએ પોતાનો તે તે	
で サン(のする した新日でる	
588550E3	

Ethyl Acetate charged into cells

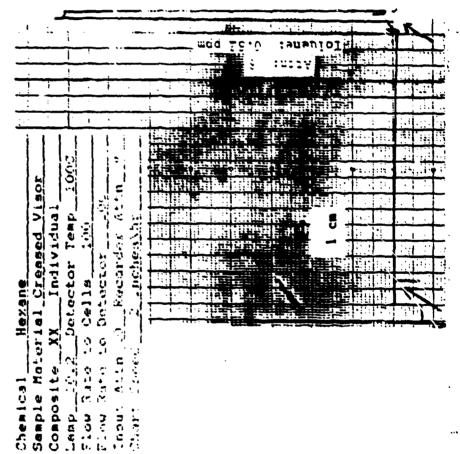
F-44

DESCRIPTION OF PRODUCT EVALUATED

2: 3:	BOOFF CTIVE MATERIAL CORE. CO			·
5:				
		, no visible imperiect:	ions	·····
4:				
5:	LOT OR MANUFACTURER DATE: N/A			
7:	فيهامه أبالنها		<del></del>	
â:		hite transparent sheet	Sample	was creased us!
•	CHEMFAB Fold Resistance Test p	rocedure of 5 September	1986.	
TE	IST METHOD			
	TESTING LABORATORY: Texas Rese			
2.		photoionization detec	tion with	a 10.20 eV lam
-	TEMPERATURE: 22-25°C			
	COLLECTION MEDIUM: N2			
	COLLECTION SYSTEM: N2	12.4.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2	<b>T</b>	= 1000
7	OTHER CONDITIONS: 1 inch cel	15 Were used. / Detector	remperat	ure = 100C.
/•	DE, VIATIONS FROM ACTM F739 METH	DD: Flow rate to cell	Were It	U cc/min.
CH	HALLENGE CHEMICAL 1	: COMPONENT 2	•	3
1-	CHEM NAME (s) : Hexane	: N/A	:	N/A
2.	CAS NUMBER(s): 110-54-3	: N/A	:	N/A
3.	CONC. (IF MIX) N/A	: N/A		N/A
Ł.	CREMICAL SOURCE: EM Science	: N/A		N/A
2. 3. 4.			r 3.1 hou	ırs.
	SAMPLE THICKNESS: 12 -41-			
6.	SAMPLE THICKNESS: 12 m11s SELECTED DATA POINTS N/A			
6.		ATION : CONCENTRAT	ION :	CONCENTRATION
6.	TIME : CONCENTR  1. :	ATION : CONCENTRAT	ION :	CONCENTRATION
6.	SELECTED DATA POINTS N/A  TIME : CONCENTR  1. :	ATION : CONCENTRAT	ION :	CONCENTRATION
6.	TIME : CONCENTR  1. : 2. : 3. : 4. :	ATION : CONCENTRAT : :	ION :	CONCENTRATION
6.	TIME : CONCENTR  1. : : : : : : : : : : : : : : : : : : :	ATION : CONCENTRAT : : : : : :	ION :	CONCENTRATION
6.	TIME : CONCENTR  1. : 2. : 3. : 4. : 5. : 6. :	ATION : CONCENTRAT	ION :	CONCENTRATION
6.	TIME : CONCENTR  1. : 2. : 3. : 4. : 5. : 6. : 7. :	ATION : CONCENTRAT : : : : : : : : : : : : : : : : : : :	ION:	CONCENTRATION
6.	TIME : CONCENTR  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :	ATION : CONCENTRAT : : : : : : : : : : : : : : : : : : :	ION :	CONCENTRATION
6.	TIME : CONCENTR  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	ATION : CONCENTRAT : : : : : : : : : : : : : : : : : : :	ION:	CONCENTRATION
6.	TIME : CONCENTR  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :	ATION : CONCENTRAT	ION :	CONCENTRATION
6. 7.	TIME : CONCENTR  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	ATION : CONCENTRAT : : : : : : : : : : : : : : : : : : :	ION :	CONCENTRATION
6. 7.	TIME : CONCENTR  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	ATION : CONCENTRAT : : : : : : : : : : : : : : : : : : :	ION:	CONCENTRATION
6. 7.	TIME : CONCENTR  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	ATION : CONCENTRAT : : : : : : : : : : : : : : : : : : :	ION :	CONCENTRATION

Chemical Resistance Testing of Creased Visor Materiai

### Hexane



Hexane charged into cells

	3: 4:		TEST: Unused, no v	isible imperfections	
	4: 5:	PRODUCT IDENTIFIC	ATION: Visor		
	6:	LOT OR MANUFACTUR	ER DATE: N/A		
	7:	NOMINAL THICKNESS	: 11-13 mil		
	8:	DESCRIPTION: Mat	orial was a white t	ransparent sheet. Samp	le was creased using
		CHEMFAB Fold Resi	stance Test procedu	re of 5 September 1986	<u> </u>
,	TES	T METHOD			
	_	TESTING LABORATOR	Y: Texas Research 1	institute, 9063 Bee Cav	es Road, Austin, TX
	2.	TEMPERATURE: 22-2		ionization detection w	TER & II./O ev lamp
	3.	COLLECTION MEDIUM			
	4. 5.	COLLECTION SYSTEM			
	5. 6.			e used./Detector Tempe	reture = 60C.
		DEVIATIONS FROM A	STM F739 METHOD: 1	low rate to cells were	100 cc/min.
	••	DEVERTIONS TROUT	DEI 1137 IE 211031 _	100 1866 10 66110 4616	
٠.	CHA	LLENGE CHEMICAL	1	: COMPONENT 2 :	; <b>3</b>
	1 .	CHEM NAME(s): P	lethanol	: N/A:	N/A
		CAS MUMBER(s): E		N/A	N/A
		CONC. (IF MIX) N		: N/A	N/A
	4.	CHEMICAL SOURCE:		: N/A	N/A
	ο.	STEADY STATE PERME			
	6. 7.	SAMPLE THICKNESS:  LECTED DATA POIN  TIME :  1. :		: CONCENTRATION :	CONCENTRATION
	6. 7.	WLECTED DATA POIN	TS N/A	: CONCENTRATION :	CONCENTRATION
	6. 7.	TIME : 1. 2. :	TS N/A	: CONCENTRATION :	CONCENTRATION
	6. 7.	TIME : 1. 2. :	TS N/A	: CONCENTRATION :	CONCENTRATION
	6. 7.	TIME : 1. 2. :	TS N/A	: CONCENTRATION :	CONCENTRATION
	6. 7.	TIME : : : : : : : : : : : : : : : : : : :	TS N/A	: CONCENTRATION :	CONCENTRATION
	6. 7.	TIME : 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :	TS N/A	: CONCENTRATION :	CONCENTRATION
	6. 7.	TIME : : : : : : : : : : : : : : : : : : :	TS N/A	: CONCENTRATION :	CONCENTRATION
	6. 7.	TIME : 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :	TS N/A		CONCENTRATION
	6. 7.	TIME : : : : : : : : : : : : : : : : : : :	CONCENTRATION		CONCENTRATION
	6. 7.	TIME : 1	CONCENTRATION		CONCENTRATION
	6. 7.	TIME : 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : OTHER OBSERVATIONS	CONCENTRATION		CONCENTRATION
	6. 7.	TIME:  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : OTHER OBSERVATIONS	CONCENTRATION		
	6. 7.	TIME:  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : OTHER OBSERVATIONS	CONCENTRATION		
	6. 7.	TIME:  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : OTHER OBSERVATIONS	CONCENTRATION		
	6. 7.	TIME:  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : OTHER OBSERVATIONS	CONCENTRATION		
	6. 7.	TIME:  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : OTHER OBSERVATIONS	CONCENTRATION		
	6. 7.	TIME:  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. : OTHER OBSERVATIONS	CONCENTRATION		

# Chemical Resistance Testing of Creased Visor

### Methanol

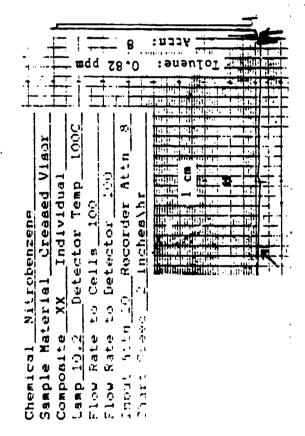
•		Ţ	 -		<u>لا۔۔</u> ۔
leal Methanol le Material Crease baite XX Individua 11.7 Detector Temp Rate to Cells 100	Flow Rate to Detector 100 Input Attn 1 Recorder Attn 4	Speed 2		を の を の の の の の の の の の の の の の	

Methanol charged into cells

1: 2:		
٠.	TYPE: Teflon	
<b>Z</b> :		
3:		. no visible imperfections
4:		
5:		
6:		
7:		
		hite transparent sheet. Sample was creased us
٠.	CHEMFAB Fold Resistance Test p	
TE	ST METHOD	
1.	TESTING LABORATORY: Texas Reserved	arch Institute, 9063 Bee Caves Road, Austin,
2.		photoionization detection with a 10.20 eV la
3.		
4.	COLLECTION MEDIUM: No	
5.	COLLECTION SYSTEM: N2	
6.	OTHER CONDITIONS: 1 inch cel	ls were used./Detector Temperature = 100C.
		OD: Flow rate to cells were 100 cc/min.
. •		- 120 PROCESS WOLL TO COMMING
CH.	ALLENGE CHEMICAL 1	: COMPONENT 2 : 3
	CHEM NAME(s): Nitrobenzene	
	CAS NUMBER(s): 98-95-3	: N/A : N/A
3.	CONC. (IF MIX) N/A	: N/A : N/A
4.	CHEMICAL SOURCE: Mallinckrod:	: N/A : N/A
2. 3. 4. 5.	DATE TESTED: 4-9-87  NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm  STEADY STATE PERMEATION RATE I SAMPLE THICKNESS: 12 mils  SELECTED DATA POINTS N/A	ugh was observed after 4 hours.
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm STEADY STATE PERMEATION RATE I SAMPLE THICKNESS: 12 mils	N/A
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm STEADY STATE PERMEATION RATE 1 SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRA	N/A
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm STEADY STATE PERMEATION RATE I SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRA  1. :	N/A
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm STEADY STATE PERMEATION RATE _1 SAMPLE THICKNESS: _12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRA  1	N/A
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm STEADY STATE PERMEATION RATE I SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRA  1. : 2. : 3. :	ATION: CONCENTRATION: CONCENTRATION: : : : : : : : : : : : : : : : : : :
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm STEADY STATE PERMEATION RATE I SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRA  1. : 2. : 3. : 4. : 5. :	ATION: CONCENTRATION: CONCENTRATION: : : : : : : : : : : : : : : : : : :
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm STEADY STATE PERMEATION RATE I SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRA  1. : 2. : 3. : 4. : 5. : 6. :	ATION: CONCENTRATION: CONCENTRATION: : : : : : : : : : : : : : : : : : :
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm STEADY STATE PERMEATION RATE I SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRA  1. : 2. : 3. : 4. : 5. : 6. : 7. :	ATION: CONCENTRATION: CONCENTRATION: : : : : : : : : : : : : : : : : : :
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm STEADY STATE PERMEATION RATE _1 SAMPLE THICKNESS: _12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRATE  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :	ATION: CONCENTRATION: CONCENTRATION:  : : : : : : : : : : : : : : : : : :
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm STEADY STATE PERMEATION RATE IS SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRATE  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	ATION: CONCENTRATION: CONCENTRATION: : : : : : : : : : : : : : : : : : :
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm STEADY STATE PERMEATION RATE _1 SAMPLE THICKNESS: _12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRATE  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :	ATION: CONCENTRATION: CONCENTRATION:  : : : : : : : : : : : : : : : : : :
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm STEADY STATE PERMEATION RATE I SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRA  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	ATION : CONCENTRATION : CONCENTRATION  : : : : : : : : : : : : : : : : : : :
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm STEADY STATE PERMEATION RATE I SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRA  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	ATION: CONCENTRATION: CONCENTRATION:  : : : : : : : : : : : : : : : : : :
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm STEADY STATE PERMEATION RATE I SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRA  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	ATION : CONCENTRATION : CONCENTRATION  : : : : : : : : : : : : : : : : : : :
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: Three BREAKTHROUGH TIME: No breakthrough MIN DETECTABLE LIMIT .04 ppm STEADY STATE PERMEATION RATE I SAMPLE THICKNESS: 12 mils SELECTED DATA POINTS N/A  TIME : CONCENTRA  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	ATION : CONCENTRATION : CONCENTRATION  : : : : : : : : : : : : : : : : : : :

# Chemical Resistance Testing of Creased Visor Material

### Nitrobenzene



Nitrobenzene charged into cella

DESCR	IPTION OF PROD	UCT EVALUATED				
1: T	YPE: Teflon					
	ROTECTIVE MATE	RIAL CODE: 09	<del></del>			
		E TEST: Unused, no	visible im	perfections		
		Dupont		A		
5: P	RODUCT IDENTIF	ICATION: Visor				
		URER DATE: N/A				
	OMINAL THICKNE					
		aterial was a white				was creased using
<u>c</u>	HEMFAB Fold Re	sistance Test proce	dure of 5 S	eptember 19	86.	
TEST	METHOD					
1. T	FSTING LARORAT	ORY: Texas Research	Instituto	9063 Ree C	avag	Road Austin TX
	NALYTICAL METH					a 11.70 eV lamp.
	EMPERATURE: 22					
	OLLECTION MEDI		<del></del>		<del></del>	
	OLLECTION SYST			<del></del>		
		S: 1 inch cells w	ere used./D	etector Tem	perat	ure = 60C.
		ASTM F739 METHOD:				
FWAT T	ENCE CHEMICAL	1	= E0100	NENT 2		3
ستحص	ENGE GREATURE	•	·	agent &	•	•
1. C	HEM NAME(e) .	Tetrachloroethane	. N	<b>/</b> A	•	N/A
	AS NUMBER(s):			/A	-:	N/A
	ONC. (IF MIX)			/A	-:	N/A
	HEMICAL SOURCE			/A	- <u>:</u>	N/A
2. NU 3. BR		S TESTED: Three E: No breakthrough	was observe	d after 3 h	ours.	
		MEATION RATE N/A				
6. SA	MPLE THICKNESS	: 12 mils				
7. SE	LECTED DATA PO	INTS N/A				
	TIME	: CONCENTRATIO	n : con	CENTRATION	:	<b>CONCENTRATION</b>
1.		:	<del></del>		<u>:</u>	
2.		<u>:</u>	<del></del>	<del> </del>	<u> </u>	
3.		<u> </u>	<del>-</del>		<u>:</u>	
4. 5.		<u>•</u>	·		•	<del></del>
5. 6.		•	<u>-</u>		<del></del> -	
7.		•	<del></del>		$\div$	
8.		•	<del>;</del>		<del></del> -	
9.		·	<del></del> :		<del>:</del>	
10	•	· •	<del>:</del>	<del></del>	<del></del>	
- •		·				
8. OT	HER OBSERVATIO	NS:				
			<del></del>			·
SOIDC	E OF DATA					
JO UKC		e run by Denise McD	oneld on A-	r41 24 109	7.	
	_ sembres wel	E TAU DA DEUTRE WCD	CHETC ON AP	111 67, 170		

# Chemical Resistance Testing of Creased Visor

NAME OF STREET

### Tetrachloroethane

	噩	Ħ	nd	đ	28	.0		: au	olue	I		重	
			i i			7		VEC					
Chemical Tetrachloroethane	4	Composite XX Individual	Lamp 11.7 Detector Temp 60C	Flow Rate to Cella 100	Flow Rate to Detector 100	Input Attn 1 Recorder Attn 4	Chart Speed 2 inches/hr		推			「「「「「」」 「」 「」 「」 「」 「」 「」 「」 「」 「」 「」 「	_

Switched from cells to standard gas Tetrachloroethane charged into cella

F-52

DESCRIPTION OF PRODUCT EVALUATED

	3: 4:		FURE .					
	4:	MANUFACTURER		rest: <u>Unused, no</u>	AIRIDIE	1mperiects	OUR	
	5.	PRODUCT IDEN						
	6:							
	7:	NOMINAL THIC			<del></del>	<del></del>		
	8:	DESCRIPTION:		erial was a white	transpa	rent sheet.	Sample	was creased was
	•			stance Test proces				
	TES	T METHOD					,	
	1.			: Texas Research				
	2.	ANALYTICAL M			toioniza	ion detect:	ion with	a 11.70 eV lar
	_	TEMPERATURE:				· · · · · · · · · · · · · · · · · · ·		
		COLLECTION M						
		COLLECTION S						
		OTHER CONDIT						
	7.	DEVIATIONS F	ROM AS	STM F739 METHOD:	Flow ra	te to cells	were 10	0 cc/min.
1	CEL	LIENCE CHEMIC	AL	1	: CO	PONENT 2	•	3
	1.	CHEM NAME (s)	: Te	trahydrofuran	•	N/A	:	N/A
		CAS NUMBER(s		)9-99 <del>-9</del>	The same of the sa	N/A		N/A
		CONC. (IF MI	•	/A		N/A		N/A
	4.	CHEMICAL SOU			_;	N/A	:	N/A
	3. : 4. ! 5. :	MIN DETECTABL	TIME: E LIMI PERMEA	No breakthrough	was obs	erved after	3.2 hou	rs.
		SELECTED DATA				<del></del>		· -· · · · · · · · · · · · · · · · · ·
		TIME 1.	:	CONCENTRATION	N : (	ONCENTRATIO	ON :	CONCENTRATION
		2.	<del>- :</del>		:	<del></del>	<del>:</del>	
		3.	:		:	<del></del>	:	
	(	4.	:		:		:	
		5,	:		:		:	
		6.	:		:		:	
		7	:		:		:	
		в	:		:		:	
		9.	:		:		:	
	1	10	:				:	
f	R. 1	OTHER OBSERVA	PTONE -	<del></del>				
. ,	J. (	JIREK UDSERVA.	TON2:	<del></del>		<del></del>		

## Chemical Resistance Testing of Creased Visor

### Tetrahydrofuran

V180r 60C			: 0.33y		
lcal Tetrahyola Material Cressite XX Indi	Flow Rate to Cells 100 Flow Rate to Detector 100 Input Attn 1 Recorder Attn	2			

Tetrahydrofuran charged into cells

DESCRIPTION OF PRODUCT EVALUATED

	1: TYPE: Teflor	_				
		MATERIAL CODE: 09				
		EFORE TEST: Unus		la (marie att		
	4: MANUFACTURE		ed, no visi	TE Impelieuri	0118	
		NTIFICATION: Vis				
		FACTURER DATE: N/				<del></del>
			<u> </u>			<del></del>
		CKNESS: 11-13 mil				
		: <u>Material was a</u> d Resistance Test				as creased using
2.	TEST METHOD					
	1. TESTING LABO	ORATORY: Texas Re	search Insti	tute. 9063 Bed	e Caves R	oad. Austin. TX
	2. ANALYTICAL N					a 11.70 eV lamp.
	3. TEMPERATURE:					
	4. COLLECTION N					
	5. COLLECTION S			<del> </del>		
	6. OTHER CONDIT		ella were us	ed./Detector	Cemperatu	re = 60C.
		FROM ASTA F739 ME	THOD: Flow	rate to cells	were 100	cc/min.
		,				00/ =====
3.	CHALLENGE CHEMIC	CAL 1	•	COMPONENT 2	•	3
	1. CHEM NAME(s)	): Toluene	:	N/A	:	N/A
	2. CAS NUMBER(s			N/A		N/A
	3. CONC. (IF M)	•	<del></del> :	N/A	:	N/A
	-	URCE:Mallinckrodt		N/A	<del></del> :	N/A
		West vite I I I I I Coul Code	<del></del> '	m/m		N/A
4.	TEST RESULTS  1. DATE TESTED: 2. NUMBER OF SAF	MPLES TESTED: T	hree			
		TIME: No breakth:		served after 3	3.3 hours	•
		LE LIMIT .40 ppm				
	5. STEADY STATE	PERMEATION RATE	N/A			
	6. SAMPLE THICKN					
	7. SELECTED DATA	A POINTS N/A				
	TIME 1.	: CONCENT	TRATION :	CO NCE NTRATIO	ON : C	ONCENTRATION
	2.	:	:		:	· · · · · · · · · · · · · · · · · · ·
	3.		:		:	<del></del>
	4.	<del></del>		<del></del>	:	
	5.	<del></del>	<del></del>		:	<del></del>
	6.	:	:	<del> </del>		
	7.	:	:	<del></del>	:	
	8.	•	:		:	<del></del>
	9.	<del></del>			:	
	10.	:	:		:	· · · · · · · · · · · · · · · · · · ·
	0 00:00		——————————————————————————————————————			
	8. OTHER OBSERVA	ATIONS:				
		<del></del>			<del></del>	
5.	SOURCE OF DATA					
	Samples	were run by Denis	se McDonald	on April 24,	1987.	

## Chemical Resistance Testing of Creased Visor Toluene

	8 0 .04	
2 T. C. C. C. C.	4 :E331	
1		
	الراب فظائما ليا	
Chemical Toluene Sample Material Created Visor Composite XX Individual	Rate to Cella 100 Rate to Detector 150 Attn 1 Recorder Attn Speed 2 incheb\hr	

Switched from cells to standard gas Toluene charged into cells

### APPENDIX G

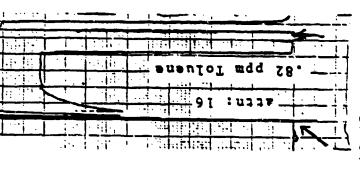
### PERMEATION TEST DATA FOR INNER GLOVE MATERIAL SAMPLES

(Data Provided by Texas Research Institute Under Contract)

TYPE: Teflon PROTECTIVE MATERIAL CODE: 044 CONDITION BEFORE TEST: Unused, no visit MANUFACTURER: Chemfab Corp. PRODUCT IDENTIFICATION: Inner glove she LOT OR MANUFACTURER DATE: N/A NOMINAL THICKNESS: 7-9 mils DESCRIPTION:  EST METHOD TESTING LABORATORY: Texas Research Inst ANALYTICAL METHOD: Continuous photoion TEMPERATURE: 22-25°C COLLECTION MEDIUM: N2	et stock	
CONDITION BEFORE TEST: Unused, no visite MANUFACTURER: Chemfab Corp.  PRODUCT IDENTIFICATION: Inner glove she LOT OR MANUFACTURER DATE: N/A NOMINAL THICKNESS: 7-9 mils  DESCRIPTION:  EST METHOD  TESTING LABORATORY: Texas Research Inst ANALYTICAL METHOD: Continuous photoion TEMPERATURE: 22-25°C	et stock	
MANUFACTURER: Chemfab Corp. PRODUCT IDENTIFICATION: Inner glove she LOT OR MANUFACTURER DATE: N/A NOMINAL THICKNESS: 7-9 mils DESCRIPTION: EST METHOD TESTING LABORATORY: Texas Research Inst ANALYTICAL METHOD: Continuous photoion TEMPERATURE: 22-25°C	et stock	
PRODUCT IDENTIFICATION: Inner glove she LOT OR MANUFACTURER DATE: N/A NOMINAL THICKNESS: 7-9 mils DESCRIPTION:  EST METHOD TESTING LABORATORY: Texas Research Inst ANALYTICAL METHOD: Continuous photoion TEMPERATURE: 22-25°C		
LOT OR MANUFACTURER DATE: N/A  NOMINAL THICKNESS: 7-9 mils  DESCRIPTION:  EST METHOD  TESTING LABORATORY: Texas Research Inst ANALYTICAL METHOD: Continuous photoion TEMPERATURE: 22-25°C		
NOMINAL THICKNESS: 7-9 mils  DESCRIPTION:  EST METHOD  TESTING LABORATORY: Texas Research Inst ANALYTICAL METHOD: Continuous photoion TEMPERATURE: 22-25°C	itute, 9063 Bee Ca	
EST METHOD  TESTING LABORATORY: Texas Research Inst ANALYTICAL METHOD: Continuous photoion TEMPERATURE: 22-25°C	itute, 9063 Bee Ca	
TESTING LABORATORY: Texas Research Inst  ANALYTICAL METHOD: Continuous photoion TEMPERATURE: 22-25°C	itute, 9063 Bee Ca	
TESTING LABORATORY: Texas Research Inst ANALYTICAL METHOD: Continuous photoion TEMPERATURE: 22-25°C	itute, 9063 Bee Ca	
ANALYTICAL METHOD: Continuous photoion. TEMPERATURE: 22-25°C	itute, 9063 Bee Ca	
TEMPERATURE: 22-25°C		
	ization detection v	with a 10.20 eV 1
COLLECTION MENTILM. V		
COLLECTION SYSTEM: N2		
OTHER CONDITIONS: 1 inch cell was use		
DEVIATIONS FROM ASTN F739 METHOD: Flow	Tate was 100 cc/a	in.
ALLENGE CHEMICAL 1 :	COMPONENT 2	<b></b>
CHEM NAME(s): Acetone :	n/A	: N/A
CAS NUMBER(s): 67-64-1 :	N/A	: N/A
CONC. (IF MIX) N/A :	N/A	: N/A
CHEMICAL SOURCE: Mallinckrodt :	N/A	: N/A
NUMBER OF SAMPLES TESTED: One (Run I)  BREAKTHROUGH TIME: 2.5 minutes  HIN DETECTABLE LIMIT .75 ppm  STEADY STATE PERMEATION RATE 128.87 ug/	cm <sup>2</sup> *hr	
SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A		
TIME : CONCENTRATION :	CONCENTRATION	: CONCENTRATION
1. ::::::::::::::::::::::::::::::::::::		<u>:</u>
2. : : : :		<u>:</u>
3		<del>:</del>
4. : :		<u> </u>
5. : :		2
6. <u>:</u> :		<u>.</u>
8.		<u> </u>
9.		•
		<u> </u>
10:		<u>:</u>
OTHER OBSERVATIONS:		
OTHER OBSERVATIONS:		
OURCE OF DATA Sample was run by Denise McDonald o	n December 17 100	6.

### Acetone Run I

-		1 0						
Chemical: Acetone Run I	rate to	t attn: 1	Chart speed: 2 inches/hour	Lamp: 10.2	Recorder attn: 512	Detector temp: 100	GLOVE LINER-INDIVIDUAL	

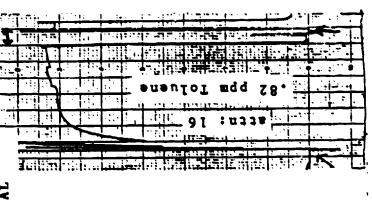


Acetone charged into cells

4: M/	NUFACTURER:	Chemfab Corp.	no visible imperfec		
): PF	CODUCT IDENTIF	ICATION: Inner	love sheet stock		
		URER DATE: N/A SS: 7-9 mils			
	SCRIPTION:	22: 1-2 BIIE		<del></del>	
· · ·					
TEST M	<b>E</b> THOD				
			rch Institute, 9063		
2. A	ALYTICAL METH	OD: Continuous	photoionization dete	ction wi	th a 10.20 eV 1
	MPERATURE: 22 OLLECTION MEDI			<del></del>	
	LLECTION MEDI				
			was used./Detector	Temperate	170 # 100C
7. DE	VIATIONS FROM	ASTM F739 METHO	: Flow Tate was 10	0 cc/min	
CHALLE	NG CHEMICAL	1	: Component 2	:	3
1. CH	TEM WATE(s):	Acetone	: :N/A	:	N/A
	S NIMBER(s):	67-64-1	: N/A	;-	N/A
2. CI					
3. co	NC. (IF MIX)	N/A	: N/A	:	N/A
3. CO 4. CH	NC. (IF MIX) EMICAL SOURCE	N/A :Mallinckrodt	: N/A : N/A		N/A N/A
3. CO 4. CH	NC. (IF MIX)	N/A			
4. CH	NC. (IF MIX) EMICAL SOURCE	N/A :Mallinckrodt			
3. CO 4. CH TEST R 1. DAT 2. NUM	NC. (IF MIX) EMICAL SOURCE ESULTS TE TESTED: 1 BER OF SAMPLE	N/A:Mallinckrodt  2-18-86 S TESTED: One ()	: N/A		
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE	NC. (IF MIX) EMICAL SOURCE ESULTS TE TESTED: 1 BER OF SAMPLE CAKTHROUGH TIME	N/A:Mallinckrodt  2-18-86 S TESTED: One (18: 2.5 minutes	: N/A		
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE 4. MIN	EMICAL SOURCE ESULTS E TESTED: 1 BER OF SAMPLE EAKTHROUGH TIME DETECTABLE L	N/A:Mallinckrodt  2-18-86 S TESTED: One () E: 2.5 minutes IMIT .85 ppm	: N/A		
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE 4. MIN 5. STE	ENC. (IF MIX) EMICAL SOURCE ESULTS TE TESTED: 1 BER OF SAMPLE CAKTHROUGH TIME DETECTABLE L EADY STATE PER	N/A:Mallinckrodt  2-18-86 S TESTED: One () E: 2.5 minutes IMIT .85 ppm MEATION RATE 14	: N/A		
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM	ESULTS ESULTS ESULTS E TESTED: 1 BER OF SAMPLE AKTHROUGH TIM DETECTABLE L ADY STATE PER	N/A :Mallinckrodt  2-18-86 S TESTED: One () E: 2.5 minutes IMIT .85 ppm MEATION RATE 14 : 7 mils	: N/A		
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM	ENC. (IF MIX) EMICAL SOURCE ESULTS TE TESTED: 1 BER OF SAMPLE CAKTHROUGH TIME DETECTABLE L EADY STATE PER	N/A :Mallinckrodt  2-18-86 S TESTED: One () E: 2.5 minutes IMIT .85 ppm MEATION RATE 14 : 7 mils	: N/A		
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM 7. SEL	NC. (IF MIX) EMICAL SOURCE ESULTS TE TESTED: 1 BER OF SAMPLE TAKTHROUGH TIME DETECTABLE L TADY STATE PER TPLE THICKNESS ECTED DATA PO	N/A :Mallinckrodt  2-18-86 S TESTED: One () E: 2.5 minutes IMIT .85 ppm MEATION RATE 14 : 7 mils	: N/A Run II) 45.66 ug/cm <sup>2</sup> *hr	TION :	
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM 7. SEL	ESULTS  E TESTED:  AKTHROUGH TIME  ACTUAL SOURCE  E TESTED:  AKTHROUGH TIME  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL SOURCE  ACTUAL SOU	N/A :Mallinckrodt  2-18-86 S TESTED: One () E: 2.5 minutes IMIT .85 ppm MEATION RATE 14 : 7 mils INTS N/A	: N/A Run II) 45.66 ug/cm <sup>2</sup> *hr	TION:	N/A
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM 7. SEL	ESULTS  E TESTED:  AKTHROUGH TIME  ACTUAL SOURCE  E TESTED:  AKTHROUGH TIME  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL STATE PER  ACTUAL SOURCE  ACTUAL SOU	N/A :Mallinckrodt  2-18-86 S TESTED: One () E: 2.5 minutes IMIT .85 ppm MEATION RATE 14 : 7 mils INTS N/A	: N/A Run II) 45.66 ug/cm <sup>2</sup> *hr	TION:	N/A
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM 7. SEL	ESULTS ES	N/A :Mallinckrodt  2-18-86 S TESTED: One () E: 2.5 minutes IMIT .85 ppm MEATION RATE 14 : 7 mils INTS N/A	: N/A Run II) 45.66 ug/cm <sup>2</sup> *hr	TION :	N/A
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM 7. SEL	ESULTS ESULTS E TESTED: 1 BER OF SAMPLE AKTHROUGH TIME DETECTABLE L ADY STATE PER UPLE THICKNESS ECTED DATA PO	N/A :Mallinckrodt  2-18-86 S TESTED: One () E: 2.5 minutes IMIT85 ppm MEATION RATE 14 : 7 mils INTS_N/A : CONCENTRATE :	: N/A Run II) 45.66 ug/cm <sup>2</sup> *hr	TION:	N/A
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM 7. SEL 1. 2. 3.	ESULTS ESULTS E TESTED: 1 BER OF SAMPLE AKTHROUGH TIME DETECTABLE L ADY STATE PER UPLE THICKNESS ECTED DATA PO	N/A :Mallinckrodt  2-18-86 S TESTED: One () E: 2.5 minutes IMIT .85 ppm MEATION RATE 14 : 7 mils INTS N/A : CONCENTRATE :	: N/A Run II) 45.66 ug/cm <sup>2</sup> *hr	TION:	N/A
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM 7. SEL	ESULTS ESULTS E TESTED: 1 BER OF SAMPLE AKTHROUGH TIME DETECTABLE L ADY STATE PER UPLE THICKNESS ECTED DATA PO	N/A :Mallinckrodt  2-18-86 S TESTED: One () E: 2.5 minutes IMIT .85 ppm MEATION RATE 14 : 7 mils INTS N/A : CONCENTRATE :	: N/A Run II) 45.66 ug/cm <sup>2</sup> *hr	TION:	N/A
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM 7. SEL 1. 2. 3. 4. 5. 6.	NC. (IF MIX) EMICAL SOURCE ESULTS  TE TESTED: 1 BER OF SAMPLE TAKTHROUGH TIME DETECTABLE L TADY STATE PER TPLE THICKNESS ECTED DATA PO TIME	N/A :Mallinckrodt  2-18-86 S TESTED: One () E: 2.5 minutes IMIT .85 ppm MEATION RATE 14 : 7 mils INTS N/A : CONCENTRATE :	: N/A Run II) 45.66 ug/cm <sup>2</sup> *hr	TION:	N/A
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM 7. SEL 1. 2. 3. 4. 5.	NC. (IF MIX) EMICAL SOURCE ESULTS  TE TESTED: 1 BER OF SAMPLE TAKTHROUGH TIME DETECTABLE L TADY STATE PER TPLE THICKNESS ECTED DATA PO TIME	N/A :Mallinckrodt  2-18-86 S TESTED: One () E: 2.5 minutes IMIT .85 ppm MEATION RATE 14 : 7 mils INTS N/A : CONCENTRATE: ::	: N/A Run II) 45.66 ug/cm <sup>2</sup> *hr	TION:	N/A
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM 7. SEL 1. 2. 3. 4. 5. 6. 7. 8.	NC. (IF MIX) EMICAL SOURCE ESULTS  TE TESTED: 1 IBER OF SAMPLE TAKTHROUGH TIME DETECTABLE L TADY STATE PER IPLE THICKNESS ECTED DATA PO  TIME	N/A :Mallinckrodt  2-18-86 S TESTED: One () E: 2.5 minutes IMIT .85 ppm MEATION RATE 14 : 7 mils INTS N/A : CONCENTRATE: ::	: N/A Run II) 45.66 ug/cm <sup>2</sup> *hr	TION:	N/A
3. CO 4. CH TEST R 1. DAT 2. NUM 3. BRE 4. MIN 5. STE 6. SAM 7. SEL 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	NC. (IF MIX) EMICAL SOURCE ESULTS  TE TESTED: 1 IBER OF SAMPLE TAKTHROUGH TIME DETECTABLE L TADY STATE PER IPLE THICKNESS ECTED DATA PO  TIME	N/A :Mallinckrodt  2-18-86 S TESTED: One () E: 2.5 minutes IMIT85 ppm MEATION RATE	: N/A Run II) 45.66 ug/cm <sup>2</sup> *hr	TION:	N/A

### Acetone Run II

Chemical: Acetone Run II
Flow rate to cells: 100
Flow rate to Detector: 100
Input attn: 10
Chart speed: 2 inches/hour
Lamp: 10.2
Recorder attn: 512
Detector temp: 100
GLOVE LINER-INDIVIDUAL



Acetone charged into cells

3: 4:	CONDITION BE	FORE TEST: Unused, : Chemfab Corp.	no visible imp	erfections	
<b>5</b> :	PRODUCT IDEN	TIFICATION: Inner gl	ove sheet stoc	k	
6:		ACTURER DATE: N/A		<del></del>	
		KNESS: 7-9 mils			
8:	DESCRIPTION:				
TE	ST METHOD				
1.	TESTING LABO	KATORY: Texas Reseat	ch Institute,	9063 Bee Cave	es Road, Austin,
		ETHOD: Continuous p	hotoionization	detection w	ith a 10.20 eV 1
	TEMPERATURE:				
	COLLECTION M			, <del></del>	
	COLLECTION S OTHER CONDIT				1000
		ROM ASTM F739 METHOD	was used. / Det	actor Tempera	ature = 100C.
<b>/</b> •	DEVIATIONS P	KOM WOIM 1/33 METHOD	: LTOM LATE M	WE THE CELETA	11+
	OTENE CENT	<b>A</b> . 1	: COMPON	ENT 2 :	3
1.	CHEM NAME (s)	: Acetone	. N/		N/A
2.	CAS NUMBEP(s	): 67-64-1	: N/		N/A
	CONC. (IF MI		: N/		N/A
4.	CHEMICAL SOU	RCE:Mallinckrodt	: N/	<u> </u>	N/A
2. 3. 4. 5.	BREAKTHROUGH MIN DETECTABL STEADY STATE SAMPLE THICKN	PLES TESTED: One (R TIME: 2.5 minutes E LIMIT .89 ppm PERMEATION RATE 145 ESS: 7 mils			
<i>/</i> .	SELECTED DATA	POINTS N/A			
	TIME	: CONCENTRAT		ENTRATION :	CONCENTRATION
	1.	<u>:</u>	<del> </del>	<u></u>	
	3. <del></del>		•		
	4.	<del></del>	<del></del>	<del></del>	
	5.	•			
	6.	•	:		· · · · · · · · · · · · · · · · · · ·
	7.		:	:	
		•	:		
	8.	:	:	:	
	9.	<u> </u>			
			:		
8.	9.	<u>:</u>	:	•	

### Acetore Run III

Chemical: Acetone Run III
Flow rate to cells:100
Input attn: 10
Chart speed: 2 inches/hour
Jamp: 10.2
Recorder attn: 512
Detector temp: 100
GLOVE LINER-INDIVIDUA:

Acetone charged into cells

	1: TYPE: Teflon 2: PROTECTIVE MATERIAL CODE: 044									
	3: CONDITION BEFORE TEST: Unused, no visible imperfections									
	4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Inner glove sheet stock									
	6:	LOT OR MANUFA	CTURER		e sheet stock					
	7:	NOMINAL THICK	ONESS:	7-9 mils						
	8:	DESCRIPTION:								
2.	TEST METHOD									
	1.	TESTING LABOR	RATORY:	Texas Research	Institute, 9063 Bee	Caves	Road, Austin, T	X		
				Gas Chromatogra	phy					
		TEMPERATURE:								
	4. E	COLLECTION ME	EDIUM:	Charcoal						
	5. 6.	OTHER CONDITI	ONS:	l inch cells we	re used.					
				M F739 METHOD:	1# OBEU					
3.	AHO .	lience Chemica	VL.	1	component 2	:	3			
	1_	CHEM NAME (s)	: Ace	tonitrile	: N/A		N/A			
	2.	CAS NUMBER(2)	): <b>2</b> 20	6-26-0	: N/A	_:_	N/A			
	3.	CONC. (IF MIX	() N/A		:N/A	:_	N/A			
	4.	CHEMICAL SOUR	Gra Gra	her-Posticide	: N/A : N/A	<u>:</u>	N/A N/A			
4.	YES	T RESULTS	018	06	·N/A	<b>'</b>	N/A			
	3. BREAKTHROUGH TIME: 5.0 minutes 4. MIN DETECTABLE LIMIT 0.6 ppm 5. STEADY STATE PERMEATION RATE (Average) 62 (ug/cm*hr) 6. SAMPLE THICKNESS: 19-20 mils 7. SELECTED DATA POINTS 60,80,100, and 120 minutes									
	<b>,</b> •	SELECIED DATA	POINTS			<del></del>	. 2			
		T IME	_	ug/cm <sup>2</sup> *hr	ug/cm <sup>2</sup> *hr		ug/cm <sup>2</sup> *hr			
		1. 60 minutes	R :	Cell 1 60	: Cell 2 : 67	:	Cell 3 73			
		2. 80 minutes		53	· 70	<del>:</del> -	64			
		3. 100 minute		59	: 61	:	52			
		4. 120 minute	26 :	57	: 65	:	60			
		5.		<del></del>	<del></del>	<u> </u>	<del></del>			
		6. 7.	<del>:</del>	<del></del>	<del></del>	<del></del> :				
		8.	<del></del> -	<del></del>	<del></del>	<del></del> -	<del></del>			
		9.	:		:	<del></del>				
		10.	:		*	:				
	8.				was collected 5 mi			of		
5.	sou	RCE OF DATA Samples we	ere run	by Denise McDor	nald on February 6,	1987。		<del></del> -		

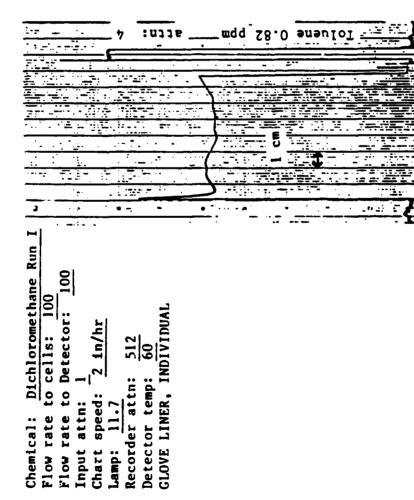
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G-8

1: 2: 3: 4: 5:	PROTECTIVE MATE CONDITION BEFOR				·
2: 3: 4: 5:	PROTECTIVE MATE CONDITION BEFOR				
3: 4: 5:	CONDITION BEFOR				
4: 5:	CONDITION BEFOR	L TLST: Unused. no			
5:	MARITEACTIONER •	2	VISIBLE	imperfections	
£ .	PRODUCT IDENTIF	ICATION: Inner gio	ve sheet	stock	
7:		SS: <u>7-9 mils</u>			
8:	DESCRIPTION:		·- · - · ·		<del></del>
ΤΈ	ST METHOD		<del></del>	**************************************	
-					
1.		ORY: Texas Research			
2.	-	OD: Continuous pho	toionizat	ion detection w	ith a 11.70 eV lam
3.					
4.					
5.	COLLECTION SYST	EM: N <sub>2</sub>			
4.	OTHER CONDITION	S: I inch cell wa	s used-/D	etector Tempera	ture = 60C.
7.	DEVIATIONS FROM	ASTM F739 METHOD:	Flow rat	e was 100 cc/mi	n.
CH	ALIENGE CHEMICAL	1	: com	PONENI 2 :	3
	######################################	<b>5.</b> 4.	•	:	4.
	CHEM NAME(s):		:	N/A :	N/A
	CAS NUMBER(s):		: <u></u>	N/A :	N/A
3.	CONC. (IF MIX)		:	N/A :	N/A
4.	CHEMICAL SOURCE	: <u>Fisher</u>	:	N/A :	N/A
2. 3. 4. 5.	NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE L	IMIT 2.57 ppm MEATION RATE 487.1		*hr)	
	SELECTED DATA PO			<del></del>	
	TIME	: CONCENTRATIO	)N : C	ONCENTRATION :	CONCENTRATION
	2.	•	<del>:</del> -	<del></del>	
	3.	:	:	•	
	4.	•	:	:	
	5.	•	<del></del>	<del></del>	·
	6.	<u>.                                    </u>	<del></del>	<del></del>	<del></del>
	7.	<u>.</u>	<del></del>	·	
	8.	<u>.</u>	<u>.</u>	<del></del>	
	9.	•	<u> </u>		
	10.	<u>·</u>	<u>•</u>	<u>.</u>	
				•	
		NC .			
8.	OTHER OBSERVATIO	113.			
8.	OTHER OBSERVATIO			A	
	URCE OF DATA	113.			

G-0

### Dichloromethane Run I



Dichloromethane charged into cella

2:	PROTECTIVE MATE	ERIAL CODE: 044			•		
3:	CONDITION BEFOR	RE TEST: Unused, no v	isible imperfectio	ns			
4:	MANUFACTURER: Chemfab Corp.						
5:							
5:							
7:							
8:							
TE	ST METHOD						
1.	TESTING LABORAT	TORY: Texas Research 1	Institute, 9063 Bee	Caves	Road, Austin,		
2.		OD: Continuous photo					
3.			·				
4.	COLLECTION MEDI	UM: No	<del></del>				
5.		EM: N <sub>2</sub>			<del> </del>		
6.	OTHER CONDITION	NS: 1 inch cell was	used./Detector Tem	perati	re = 60C.		
7.		ASTM F739 METHOD: F					
CH	ALIENGE CHEMICAL	1	: COMPONENT 2	:	3		
1.	CHEM NAME(s):	Dichloromethane	:N/A	:_	N/4		
2.	CAS NUMBER(s):	75-09-2	: N/A	<del></del> :-	N/A		
-	CONC. (IF MIX)	N/A	: N/A		N/A		
3.							
4. TE:	CHEMICAL SOURCE ST RESULTS  DATE TESTED: 1	: <u>Fisher</u> - 1-29-87	: N/A	:_	N/A		
4. TE: 1. 2. 3. 4.	CHEMICAL SOURCE ST RESULTS  DATE TESTED:  NUMBER OF SAMPLE BREAKTHROUGH TIME MIN DETECTABLE I	E:Fisher  1-29-87  S:TESTED: One (Run I  1E: 2.5 minutes  LIMIT 2.57 ppm	.1)		N/A		
4. TE: 1. 2. 3. 4. 5.	CHEMICAL SOURCE ST RESULTS  DATE TESTED:  NUMBER OF SAMPLE BREAKTHROUGH TIME MIN DETECTABLE I	E:Fisher  1-29-87 ES_TESTED: One (Run 1  1E: 2.5 minutes  LIMIT 2.57 ppm  RMEATION RATE 507.95	.1)		N/A		
1. 2. 3. 4. 5.	CHEMICAL SOURCE ST RESULTS  DATE TESTED: 1 NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE 1 STEADY STATE PER	I-29-87 IS.TESTED: One (Run I IE: 2.5 minutes LIMIT 2.57 ppm RMEATION RATE 507.95 IS: 7 mils	.1)	•	N/A		
4. TE: 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCE ST RESULTS  DATE TESTED: I NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO	E:Fisher  1-29-87 ES_TESTED: One (Run I  1E: 2.5 minutes  LIMIT 2.57 ppm  2MEATION RATE 507.95  3: 7 mils  CONCENTRATION  : CONCENTRATION	(ug/cm <sup>2</sup> *hr)	N :			
1. 2. 3. 4. 5.	CHEMICAL SOURCE ST RESULTS  DATE TESTED: I NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO	E:Fisher  1-29-87 ES_TESTED: One (Run I  1E: 2.5 minutes  LIMIT 2.57 ppm  RMEATION RATE 507.95  S: 7 mils  DINTS N/A	(ug/cm <sup>2</sup> *hr)	N :			
1. 2. 3. 4. 5.	CHEMICAL SOURCE ST RESULTS  DATE TESTED:  NUMBER OF SAMPLE BREAKTHROUGH TIMMIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO  TIME  1.  2.	E:Fisher  1-29-87 ES_TESTED: One (Run I  1E: 2.5 minutes  LIMIT 2.57 ppm  2MEATION RATE 507.95  3: 7 mils  CONCENTRATION  : CONCENTRATION	(ug/cm <sup>2</sup> *hr)	N :			
1. 2. 3. 4. 5.	CHEMICAL SOURCE ST RESULTS  DATE TESTED: 1 NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO  TIME  1. 2. 3.	E:Fisher  1-29-87 ES_TESTED: One (Run I  1E: 2.5 minutes  LIMIT 2.57 ppm  2MEATION RATE 507.95  3: 7 mils  CONCENTRATION  : CONCENTRATION	(ug/cm <sup>2</sup> *hr)	N :			
1. 2. 3. 4. 5.	CHEMICAL SOURCE ST RESULTS  DATE TESTED: I NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO  TIME  1. 2. 3. 4.	E:Fisher  1-29-87 ES_TESTED: One (Run I  1E: 2.5 minutes  LIMIT 2.57 ppm  2MEATION RATE 507.95  3: 7 mils  CONCENTRATION  : CONCENTRATION	(ug/cm <sup>2</sup> *hr)	N :			
1. 2. 3. 4. 5.	CHEMICAL SOURCE ST RESULTS  DATE TESTED: I NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO  TIME  1. 2. 3. 4. 5.	E:Fisher  1-29-87 ES_TESTED: One (Run I  1E: 2.5 minutes  LIMIT 2.57 ppm  2MEATION RATE 507.95  3: 7 mils  CONCENTRATION  : CONCENTRATION	(ug/cm <sup>2</sup> *hr)  : CONCENTRATIO :	N :			
4. TE: 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCE ST RESULTS  DATE TESTED: I NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO  TIME  1. 2. 3. 4. 5. 6.	E:Fisher  I-29-87 ES TESTED: One (Run Interpretation of the concentration  (ug/cm <sup>2</sup> *hr)  : CONCENTRATIO :	N :				
4. TE: 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCE ST RESULTS  DATE TESTED: I NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO  TIME  1. 2. 3. 4. 5. 6. 7.	E:Fisher  1-29-87 ES_TESTED: One (Run I  1E: 2.5 minutes  LIMIT 2.57 ppm  2MEATION RATE 507.95  3: 7 mils  CONCENTRATION  : CONCENTRATION	(ug/cm <sup>2</sup> *hr)  : CONCENTRATIO :	N :			
4. TE: 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCE ST RESULTS  DATE TESTED: I NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO  TIME  1. 2. 3. 4. 5. 6. 7. 8.	E:Fisher  I-29-87 ES TESTED: One (Run Interpretation of the concentration  (ug/cm <sup>2</sup> *hr)  : CONCENTRATIO :	N : : : : : : : : : : : : : : : : : : :				
4. TE: 1. 2. 3. 4. 5. 6.	CHEMICAL SOURCE ST RESULTS  DATE TESTED: I NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	E:Fisher  I-29-87 ES TESTED: One (Run Interpretation of the concentration  (ug/cm <sup>2</sup> *hr)  : CONCENTRATIO :	N : : : : : : : : : : : : : : : : : : :				
1. 2. 3. 4. 5.	CHEMICAL SOURCE ST RESULTS  DATE TESTED: I NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO  TIME  1. 2. 3. 4. 5. 6. 7. 8.	E:Fisher  I-29-87 ES TESTED: One (Run Interpretation of the concentration  (ug/cm <sup>2</sup> *hr)  : CONCENTRATIO :	N :				
4. TE: 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOURCE ST RESULTS  DATE TESTED: I NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	E:Fisher  I-29-87 ES_TESTED: One (Run Interpretation of the state of t	(ug/cm <sup>2</sup> *hr)  : CONCENTRATIO : :	: : : : : : : : : : : : : : : : : : : :			
4. TE 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOURCE ST RESULTS  DATE TESTED: I NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	E:Fisher  I-29-87 ES_TESTED: One (Run Interpretation of the state of t	(ug/cm <sup>2</sup> *hr)  : CONCENTRATIO :	: : : : : : : : : : : : : : : : : : : :			
4. TE: 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOURCE ST RESULTS  DATE TESTED: I NUMBER OF SAMPLE BREAKTHROUGH TIM MIN DETECTABLE I STEADY STATE PER SAMPLE THICKNESS SELECTED DATA PO  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	E:Fisher  I-29-87 ES_TESTED: One (Run Interpretation of the state of t	(ug/cm <sup>2</sup> *hr)  : CONCENTRATIO : :	: : : : : : : : : : : : : : : : : : : :			

### Dichloromethane Run II

007

Flow rate to Detector:

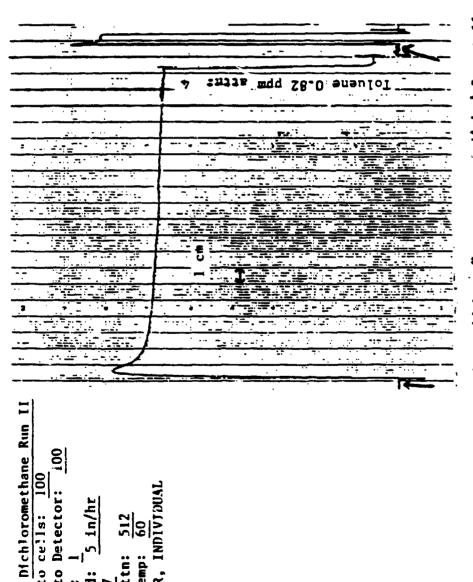
Chart speed: Input attn:

Lamp:

Flow rate to cells:

Chemcial:

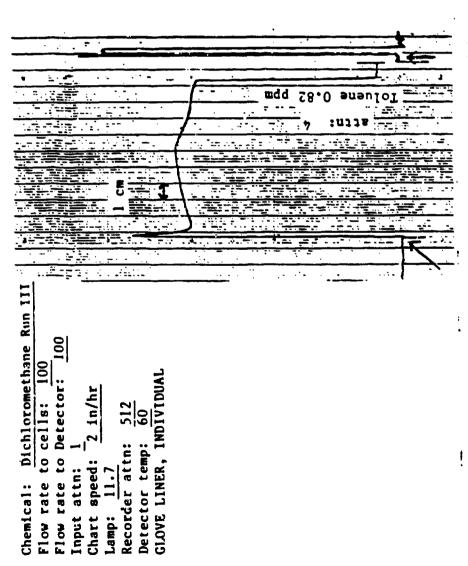
Recorder attn: 512 Detector temp: 60 GLOVE LINER, INDIVIOUAL



Dichloromethane charged into cells

	DES	CRIPTION OF PRODU	JCT EVALUATED							
	1: TYPE: Teflon									
	2:	PROTECTIVE MATER								
	3: 4:		TEST: Unused, r	o visible imperfection	ons					
	<b>5</b> :	PRODUCT IDENTIFI	CATION: Inner gl	ove sheet stock						
	6:	LOT OR MANUFACTU	JRER DATE: N/A	TOTAL DIRECT SECON						
		NOMINAL THICKNES	S: 7-9 mils							
	8:	DESCRIPTION:								
2.	TES	T METHOD			· ·					
	1.	TESTING LABORATO	ORY: Texas Researc	h Institute, 9063 Bee	Caves	Road, Austin, TX				
				otoionization detecti	ion wit	h a 11.70 eV lamp.				
	3. 4.									
	5.	COLLECTION SYSTE	M: N <sub>2</sub>		<del></del>					
	<b>.</b>	OTHER CONDITIONS	: linch cell w	as used. Detector Ter	peratu	re = 60C.				
			ASTM F739 METHOD:	Flow rate was 100 t	c/min.					
L	CHA	LIENCE CHEMICAL	1	: COMPONENT 2	:	3				
		CHEM NAME(s):		:N/A	:_	N/A				
		CAS NUMBER(s):		: <u>N/A</u>	:-	N/A				
	4.	CONC. (IF MIX) CHEMICAL SOURCE:		: N/A : N/A	<b>:</b>	N/A N/A				
4.	1.	T RESULTS  DATE TESTED: 1-	-29-87							
<b>4.</b>	1. 2. 3. 4.	T RESULTS  DATE TESTED: 1- NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM	-29-87 TESTED: One (Ru : 2.5 minutes MIT 2.60 ppm HEATION RATE 498.	in III)						
4.	1. 2. 3. 4. 5.	T RESULTS  DATE TESTED: 1- NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI	29-87 TESTED: One (Rule: 2.5 minutes MIT 2.60 ppm TEATION RATE 498. 7 mils	in III)						
4.	1. 2. 3. 4. 5. 6. 7.	T RESULTS  DATE TESTED: 1- NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS:	29-87 TESTED: One (Rule: 2.5 minutes MIT 2.60 ppm TEATION RATE 498. 7 mils	52 (ug/cm <sup>2</sup> *hr)	ON :	CONCENTRATION				
4.	1. 2. 3. 4. 5. 6. 7.	T RESULTS  DATE TESTED: 1- NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME  1. 2.	-29-87 TESTED: One (Rule: 2.5 minutes MIT 2.60 ppm HEATION RATE 498. 7 mils N/A	52 (ug/cm <sup>2</sup> *hr)  ON : CONCENTRATIO	ON :					
4.	1. 2. 3. 4. 5. 6. 7.	T RESULTS  DATE TESTED: 1- NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI	-29-87 TESTED: One (Rule: 2.5 minutes MIT 2.60 ppm HEATION RATE 498. 7 mils N/A	52 (ug/cm <sup>2</sup> *hr)  ON : CONCENTRATIO :	DN:					
4.	1. 2. 3. 4. 5. 6. 7.	T RESULTS  DATE TESTED: 1- NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME  1. 2.	-29-87 TESTED: One (Rule: 2.5 minutes MIT 2.60 ppm HEATION RATE 498. 7 mils N/A	52 (ug/cm <sup>2</sup> *hr)  ON : CONCENTRATIO	ON:					
4.	1. 2. 3. 4. 5. 6. 7.	T RESULTS  DATE TESTED: 1- NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME:: 1. :: 2. :: 3. :: 4. :: 5. :: 6. ::	-29-87 TESTED: One (Rule: 2.5 minutes MIT 2.60 ppm HEATION RATE 498. 7 mils N/A	52 (ug/cm <sup>2</sup> *hr)  ON : CONCENTRATIO :	ON :					
4.	1. 2. 3. 4. 5. 6. 7.	T RESULTS  DATE TESTED: 1- NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1	-29-87 TESTED: One (Rule: 2.5 minutes MIT 2.60 ppm HEATION RATE 498. 7 mils N/A	52 (ug/cm <sup>2</sup> *hr)  ON : CONCENTRATIO :	ON:					
4.	1. 2. 3. 4. 5. 6. 7.	T RESULTS  DATE TESTED: 1- NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1	-29-87 TESTED: One (Rule: 2.5 minutes MIT 2.60 ppm HEATION RATE 498. 7 mils N/A	52 (ug/cm <sup>2</sup> *hr)  ON : CONCENTRATIO : : : : :	ON :					
4.	1. 2. 3. 4. 5. 6. 7.	T RESULTS  DATE TESTED: 1- NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1	-29-87 TESTED: One (Rule: 2.5 minutes MIT 2.60 ppm HEATION RATE 498. 7 mils N/A	52 (ug/cm <sup>2</sup> *hr)  ON : CONCENTRATIO : : :	ON:					
4.	1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 1- NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME:: 1. :: 2. :: 3. :: 4. :: 5. :: 6. :: 7. :: 8. :: 9. :: 10. ::	-29-87 TESTED: One (Rule: 2.5 minutes MIT 2.60 ppm HEATION RATE 498. 7 mils MITS N/A CONCENTRATI	52 (ug/cm <sup>2</sup> *hr)  ON : CONCENTRATIO : : : : :	ON :					
••	1. 2. 3. 4. 5. 6. 7.	T RESULTS  DATE TESTED: 1- NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1. 2. 3. 4. 5. 6. 7. 8. 9.	-29-87 TESTED: One (Rule: 2.5 minutes MIT 2.60 ppm HEATION RATE 498. 7 mils MITS N/A CONCENTRATI	52 (ug/cm <sup>2</sup> *hr)  ON : CONCENTRATIO : : : : :	ON :					
i.	1. 2. 3. 4. 5. 6. 7.	T RESULTS  DATE TESTED: 1- NUMBER OF SAMPLES BREAKTHROUGH TIME MIN DETECTABLE LI STEADY STATE PERM SAMPLE THICKNESS: SELECTED DATA POI  TIME: 1. :: 2. :: 3. :: 4. :: 5. :: 6. :: 7. :: 8. :: 9. :: 10. :: OTHER OBSERVATION	TESTED: One (Rule: 2.5 minutes MIT 2.60 ppm HEATION RATE 498. 7 mils N/A CONCENTRATI	52 (ug/cm <sup>2</sup> *hr)  ON : CONCENTRATIO : : : : :						

## Dichloromethane Run III



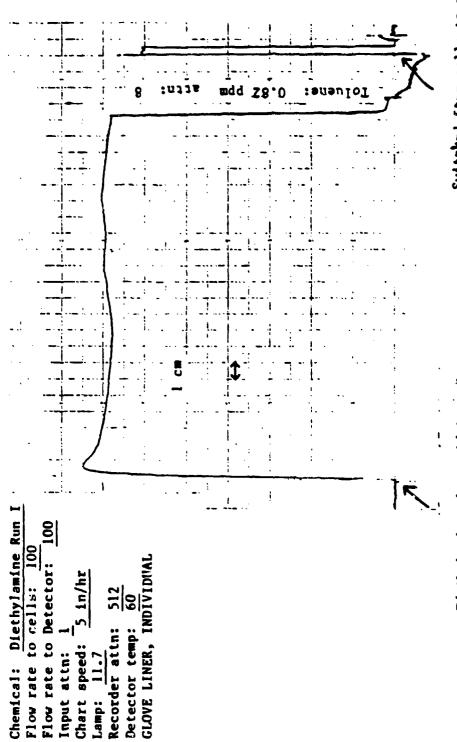
Dichloromethane charged into cells

Switched from cells to standard gas

G-14

3:		FORE TES	T: Unused, no v	lsible imperfecti	ons	
4:	MANUFACTURER	: Chemf	ab Corp.			
5:	PRODUCT IDEN	TIFICATI	ON: Inner glove	sheet stock		
5:	LOT OR MANUF					
7: B:			/-9 mils			
D:		<del></del>				
TES	ST METHOD					
1.				nstitute, 9063 Be		
2.				lonization detect	ion with	a 11.70 eV 1
3.	TEMPERATURE: COLLECTION M					
4. 5.		_			<del></del>	
				sed. /Detector Te	mneratur	e = 60C.
-				ow rate was 100		
344	ALLENGE CHEMIC	AL	.1	COMPONENT 2	•	3
١.	CHEM NAME(s)	: Diet	hylamine	N/A	: :	N/A
-	CAS NUMBER (s	;): 179-	89-7	N/A	:	N/A
3.	CONC. (IF MI	(X) N/A	:	N/A	:	N/A
• •	CHEMICAL SOU	RCE: EFI S	clence	N/A		N/A
(ES	ST RESULTS					
١.	DATE TESTED:	2-2-87				
2.	NUMBER OF SAM	PLES TES	TED: One(Run I)			
	BREAKTHROUGH					
4.	MIN DETECTABL	E LIMIT_	4.75 ppm			
5.	STEADY STATE	PERMEATI	ON RATE 1124 (1	ug/cm2*hr)		
	SAMPLE THICKN					
,	SELECTED DATA	POINTS	N/A			
7.	TIME 1.	<b>:</b>	CONCENTRATION	: CONCENTRATI	ON :	CONCENTRATION
•	2.	:		:	:	
•	3.	:		:	:	
•		:		:		
•	4.	:		<u>:</u>	:	
•	5.			<del></del>		
•	5			•		
•	5. 6. 7.					
•	5				<del></del> -	
•	5			:		
<b>'•</b>	5					
	5	TIONS:		:	:	

### Diethylamine Run !



Diethylamino charged into ceils

Switched from cells to standard gas

G-16

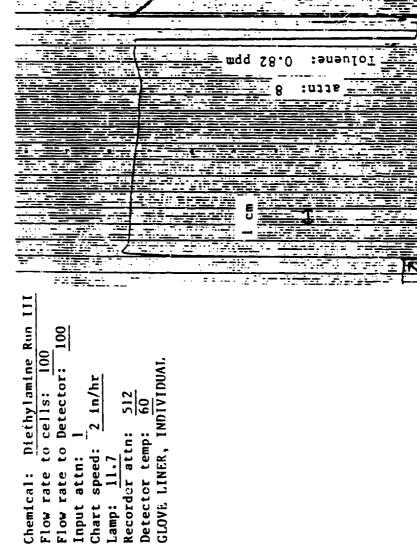
	Dze	CHEMICAL PROTECTIVE CLOTHING PRODUCT EVALUA SCRIPTION OF PRODUCT EVALUATED	
•	M3	DONALLATOR OF THOUSEL BANKURIED	•
	1:	TYPE: Teflon PROTECTIVE MATERIAL CODE: 044	
	2: 3:	المراجع بين بالمنظمين التيار المراجع بين المراجع المراجع بين المراجع المراجع المراجع المراجع المراجع المراجع ا	ons
		MANUFACTURER: Chemfab Corp.	
	5:	PRODUCT IDENTIFICATION: Inner glove sheet stock	
		LOT OR MANUFACTURER DATE: N/A	
		NOMINAL THICKNESS: 7-9 mils	
	0:	DESCRIPTION:	
<b>?</b> •	TES	ST METHOD	
		TESTING LABORATORY: Texas Research Institute, 9063 Be	
		ANALYTICAL METHOD: Continuous photoionization detect	tion with a 11.70 eV lamp.
	3. 4.	TEMPERATURE: 22-25°C COLLECTION MEDIUM: N2	
		COLLECTION SYSTEM: N2	
	6.	OTHER CONDITIONS: 1 inch cell was used. Detector Te	emperature = 50C.
•	7.	DEVIATIONS FROM ASTM F739 METHOD: Flow Tate was 100	ec/min.
<b>L</b>	COL	ALLENGE CHEMICAL 1 : COMPONENT 2 :	: 3 :
		CHEM NAME(s): Diethylamine : N/A	:: N/A
		CAS NUMBER(s): 109-69-7 : N/A	N/A
		CONC. (IF MIX) N/A : N/A  CHEMICAL SOURCE: EM Science : N/A	: N/A N/A
	. •		
	TES	ST RESULTS	
	1.	DATE TESTED: 2-3-87	
<b>.</b>	1. 2. 3.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes	
<b>.</b>	1. 2. 3.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes	
<b>.</b>	1. 2. 3. 4. 5.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)	
<b>.</b>	1. 2. 3. 4. 5.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)  SAMPLE THICKNESS: 7 mils	
<b>.</b>	1. 2. 3. 4. 5.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)	
<b>.</b>	1. 2. 3. 4. 5.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)  SAMPLE THICKNESS: 7 mils	
<b>.</b>	1. 2. 3. 4. 5.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION	
<b>.</b>	1. 2. 3. 4. 5.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: 2	
<b>.</b>	1. 2. 3. 4. 5.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION  1. : :	
<b>.</b>	1. 2. 3. 4. 5.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION  1. : :	
<b>.</b>	1. 2. 3. 4. 5.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION  1. : : : 2. : : : 3. : : : : 4. : : : : :	
<b>.</b>	1. 2. 3. 4. 5.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:  2. : : : : : : : : : : : : : : : : : : :	
<b>.</b>	1. 2. 3. 4. 5.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:  2. : : : : : : : : : : : : : : : : : : :	
<b>.</b>	1. 2. 3. 4. 5.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:	
<b>.</b>	1. 2. 3. 4. 5.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:  2. : : : : : : : : : : : : : : : : : : :	
<b>.</b>	1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²+hr)  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: 1	
<b>.</b>	1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:	
<b>i.</b>	1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:  1. : : : : : : : : : : : : : : : : : : :	ION : CONCENTRATION : : : : : : : : : : : : : : : : : : :
<b>i.</b>	1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:	ION : CONCENTRATION : : : : : : : : : : : : : : : : : : :
•	1. 2. 3. 4. 5. 6. 7.	DATE TESTED: 2-3-87  NUMBER OF SAMPLES TESTED: One (Run II)  BREAKTHROUGH TIME: 2.5 minutes  MIN DETECTABLE LIMIT 4.72 ppm  STEADY STATE FERMEATION RATE 1116 (ug/cm²*hr)  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:  1. : : : : : : : : : : : : : : : : : : :	ION: CONCENTRATION: :::::::::::::::::::::::::::::::::::

### Diethylamine Run II

Diethylamine charged into cette

	3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp.								
			FICATION: Inner gl	love sheet stock					
			TURER DATE: N/A	Total State					
			ESS: 7-9 mils						
	8: D	ESCRIPTION:							
•	TEST	METHOD							
				th Institute, 9063 Bee C					
		NALYTICAL MET EMPERATURE: 2		notoionization detection	with a 11.70 ev lamp.				
		OLLECTION MED							
		COLLECTION SYS							
	6. 0	THER CONDITION	NS: linch cell w	as used. Detector Tampe	rature = 60C.				
	7. 3	EVIATIONS FROM	M ASTM F739 METHOD:	Flow rate was 100 cc/	min.				
	CHALL	ENGE CHEMICAL	1	: COMPONENT 2	: 3				
	1. C	HEM NAME(s):	Diethylamine	: N/A	: N/A				
	2. £	AS NUMBER(s):	109-89-7	: N/A	: N/A				
		ONC. (IF MIX)		:N/A	: N/A				
	4. C	HEMICAL SOURCE	E:E! Science	: N/A	:N/A				
	1. DA 2. NU 3. BR	EAKTHROUGH TI	ES TESTED: One (Ru ME: 2.5 minutes	in III)					
	1. DA 2. NU 3. BR 4. MI 5. ST	TE TESTED: MBER OF SAMPLE EAKTHROUGH TU N DETECTABLE	ES TESTED: One (RumE: 2.5 minutes LIMIT 4.60 ppm RMEATION RATE 107						
	1. DA 2. NU 3. BR 4. MI 5. SI 6. SA	TE TESTED: MBER OF SAMPLE EAKTHROUGH THE N DETECTABLE: EADY STATE PE	ES TESTED: One (RumE: 2.5 minutes LIMIT 4.60 ppm RMEATION RATE 107 S: 7 mils						
	1. DA 2. NU 3. BR 4. MI 5. SI 6. SA	TE TESTED: MBER OF SAMPLE EAKTHROUGH TIE N DETECTABLE EADY STATE PE MPLE THICKNES	ES TESTED: One (RumE: 2.5 minutes LIMIT 4.60 ppm RMEATION RATE 107 S: 7 mils	2 (ug/cm*hr)	: CONCENTRATION				
	1. DA 2. NU 3. BR 4. MI 5. SI 6. SA 7. SE	TE TESTED: MBER OF SAMPU EAKTHROUGH TU N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P	ES TESTED: One (RumE: 2.5 minutes LIMIT 4.60 ppm RMEATION RATE 107 S: 7 mils OINTS N/A	/2 (ug/cm*hr)	: CONCENTRATION				
	1. DA 2. NU 3. BR 4. MI 5. ST 6. SA 7. SE	TE TESTED: MBER OF SAMPU EAKTHROUGH TU N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P	ES TESTED: One (RumE: 2.5 minutes LIMIT 4.60 ppm RMEATION RATE 107 S: 7 mils OINTS N/A	/2 (ug/cm*hr)	: CONCENTRATION				
	1. DA 2. NU 3. BR 4. MI 5. SI 6. SA 7. SE	TE TESTED: MBER OF SAMPU EAKTHROUGH TU N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P	ES TESTED: One (RumE: 2.5 minutes LIMIT 4.60 ppm RMEATION RATE 107 S: 7 mils OINTS N/A	/2 (ug/cm*hr)	: CONCENTRATION				
	1. DA 2. NU 3. BR 4. MI 5. SI 6. SA 7. SE	TE TESTED: MBER OF SAMPU EAKTHROUGH TU N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P	ES TESTED: One (RumE: 2.5 minutes LIMIT 4.60 ppm RMEATION RATE 107 S: 7 mils OINTS N/A	/2 (ug/cm*hr)	: CONCENTRATION :				
	1. DA 2. NU 3. BR 4. MI 5. ST 6. SA 7. SE	TE TESTED: MBER OF SAMPU EAKTHROUGH TU N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P	ES TESTED: One (RumE: 2.5 minutes LIMIT 4.60 ppm RMEATION RATE 107 S: 7 mils OINTS N/A	/2 (ug/cm*hr)	: CONCENTRATION				
	1. DA 2. NU 3. BR 4. MI 5. ST 6. SA 7. SE 1. 2. 3. 4. 5.	TE TESTED: MBER OF SAMPU EAKTHROUGH TU N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA P	ES TESTED: One (RumE: 2.5 minutes LIMIT 4.60 ppm RMEATION RATE 107 S: 7 mils OINTS N/A	/2 (ug/cm*hr)  ON : CONCENTRATION : : : : : :	: CONCENTRATION :				
	1. DA 2. NU 3. BR 4. MI 5. ST 6. SA 7. SE 1. 2. 3. 4. 5. 6.	TE TESTED: MBER OF SAMPU EAKTHROUGH TU N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA PO TIME	ES TESTED: One (RumE: 2.5 minutes LIMIT 4.60 ppm RMEATION RATE 107 S: 7 mils OINTS N/A	/2 (ug/cm*hr)  ON : CONCENTRATION : : : : : : :	: CONCENTRATION : :				
	1. DA 2. NU 3. BR 4. MI 5. ST 6. SA 7. SE 1. 2. 3. 4. 5.	TE TESTED: MBER OF SAMPU EAKTHROUGH TU N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA PO TIME	ES TESTED: One (RumE: 2.5 minutes LIMIT 4.60 ppm RMEATION RATE 107 S: 7 mils OINTS N/A	/2 (ug/cm*hr)  ON : CONCENTRATION : : : : : :	: CONCENTRATION :				
	1. DA 2. NU 3. BR 4. MI 5. ST 6. SA 7. SE 1. 2. 3. 4. 5. 6. 7.	TE TESTED: MBER OF SAMPU EAKTHROUGH TU N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA PO TIME	ES TESTED: One (RumE: 2.5 minutes LIMIT 4.60 ppm RMEATION RATE 107 S: 7 mils OINTS N/A  : CONCENTRATI : : : : : :	/2 (ug/cm*hr)  ON : CONCENTRATION : : : : : : :	: CONCENTRATION : : : : :				
	1. DA 2. NU 3. BR 4. MI 5. ST 6. SA 7. SE 1. 2. 3. 4. 5. 6. 7. 8. 9. 10	TE TESTED: MBER OF SAMPLE EAKTHROUGH TIE N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA PE TIME  HER OBSERVATION	ES TESTED: One (RumE: 2.5 minutes LIMIT 4.60 ppm RMEATION RATE 107 S: 7 mils OINTS N/A  : CONCENTRATI : : : : : :	/2 (ug/cm*hr)  ON : CONCENTRATION : : : : : : :	: CONCENTRATION : :				
	1. DA 2. NU 3. BR 4. MI 5. ST 6. SA 7. SE 1. 2. 3. 4. 5. 6. 7. 8. 9. 10	TE TESTED: MBER OF SAMPU EAKTHROUGH TU N DETECTABLE EADY STATE PE MPLE THICKNES LECTED DATA PO TIME  TIME  CHER OBSERVATION E OF DATA	ES TESTED: One (RumE: 2.5 minutes LIMIT 4.60 ppm RMEATION RATE 107 S: 7 mils OINTS N/A  : CONCENTRATI : : : : : : : : : : : : : : : : : : :	/2 (ug/cm*hr)  ON : CONCENTRATION : : : : : : :					

### Diethylamine Run III

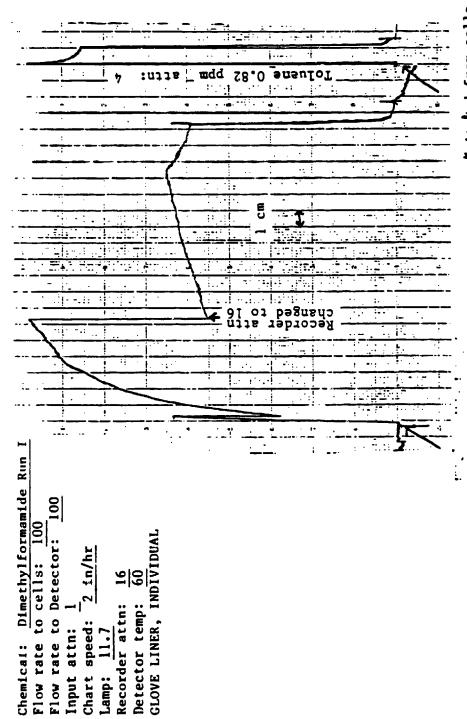


Diethylamine charged into cells

	CRIPIION OF	PRODUCI 2	VALUATED				
1:	TYPE: Teflo	n					
2:	PROTECTIVE	MATERIAL					
			T: Unused, no	visibl	e imperfectio	ns	
4:	MANUFACTURE	R: Chemf	ab Corp.				<del></del>
5:	PRODUCT IDE	NTIFICATI	ON: Inner glov	e shee	t stock		
6:	LOT OR MANU	FACTURER :	DATE: N/A				
	NOMINAL THI		7-9 mils				
8:	DESCRIPTION	:					
TES	T METHOD			-			•
1.	TESTING LAB	ORATORY:	Texas Research	Instit	ute, 9063 Bee	Caves	Road, Austin, TX
							h a 11.70 eV lamp
3.	TEMPE RATURE	: 22-25°C			<del></del>		
	COLLECTION						
	COLLECTION :						
			l inch cell was				
7.	DEVIATIONS :	FROM ASIM	F739 METHOD:	flow r	ate was 100 c	c/min.	
CHA	ltenge chemi	CAL	1	: t	OMPONENT 2	:	3
1.	CHEM NAME (e	): Dime	thylformamide	•	N/A	•	N/A
2.	CAS NUMBER(	$s$ ): $\frac{68-1}{68}$	2-2	-:	N/A	— <u>:</u> —	N/A
3.	CONC. (IF M	IX) N/A		-:	N/A	:-	N/A
	CHEMICAL SO			-:	N/A		N/A
2. 1 3. 1 4. 1 5. 9	BREAKTHROUGH MIN DETECTAB	MPLES TESTIME: LE LIMIT PERMEATINESS: 7	TED: One (Run 2.5 minutes .28 ppm ON RATE 49.19 mils		2*hr)		
	TIME	:	CONCENTRATION	:	CONCENTRATIO	N :	CONCENTRATION
	1. 2.	<u>:</u>		<del></del>		<u>:</u> _	
	3.	<u> </u>	<del></del>	<del></del>		<u>:</u>	
	·			<del>-</del>		<del></del>	
	5.	:		:		:	
		•	<del></del>	:	······································	:	<del></del>
;	6. 7.	:	<del></del>	:		:	
1	в	:		:		:	
	9	:		:		:	
1	10.	:		:		:	
8, (	OTHER OBSERV	ATIONS: _		<del></del>			
		-					
SOU	RCE OF DATA						

## Dimethylformamide Run

Input attn:



Dimethylformamide charged into cells

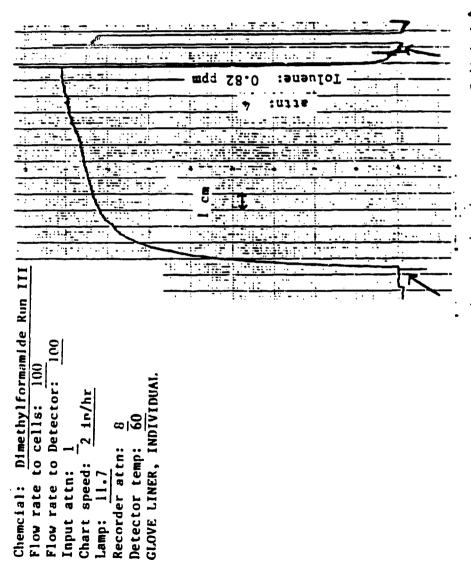
1.	DES	CRIPTION	OF PRODU	JCT EVALUATED				
		TYPE: Te						
				RIAL CODE: 044				
				Chemfab Corp.	d, no visi	ole imperfection	ons	
				CATION: Inne	r glove she	et stock		
				RER DATE: N/A				
				S: 7-9 mils				
	8:	DESCRIPT	ION:					
2.	TES	T METHOD						
								Road Austin, TX
					s photoion:	zation detecti	ion wit	h a 11.70 eV lamp.
		TEMPERATI						
		COLLECTION						
					11 was used	. /Detector Ter	<b>Dera</b> tii	re = 60C.
	7.	DEVIATION	NS FROM	ASTM F739 MET	HOD: Flow	rate was 100 c	c/min.	
3.	CHA	TIENG CH	emical	1	<b>:</b>	COMPONENT 2	:	3
	1.	CHEM NAM	E(s):	Dimethylforma	mide :	N/A	:	N/A
		CAS NUMB				N/A	:_	N/A
		CONC. (I			:_	N/A	:_	N/A
	4.	CHEMIC AL	SOURCE	Mallinckrodt	:	N/A	i	N/A
4.	TES	T RESULTS						
		DATE TEST		27-87				
		NUMBER OF			(Run II)			
		BREAKTHRO		2.5 minut MIT .30 ppm	es			
				EATION RATE		·m² *h r \		
		SAMPLE TH			30.73 (ug/	.ш "нг/	^	· · · · · · · · · · · · · · · · · · ·
	7.	SELECTED 1	DATA PO	INTS N/A		·		
		· 	_					
		TIM	E :	CONCENT	RATION :	CONCENTRATIO	ON :	CONCENTRATION
		1. 2.	<u>.</u>		<del></del>		<del></del> :-	, <del>.,,</del>
		3.	<u>-</u>	<del></del>	<u> </u>		<del></del>	
		4.			<del></del>		;	
		5.			:	·····	:	
		6.			:		:	
							<u>:</u>	
		7.		·	<u> </u>	<del></del>	:	
		7 8					<u>-</u> _	
		7. 8. 9.						
		7. 8. 9.			:		:	
		7. 8. 9.			:		:	
5.	8.	7. 8. 9. 10. OTHER OBSI	ERVATION	is:	:			
•	8.	7. 8. 9. 10. OTHER OBSI	ERVATION	is:	: : : :	January 27, 19	987.	

## Dimethylformamide Hun II

The state state at	ana peri nai p <del>iana naj</del> inan ana ana aya ya ya ya ya sara ya ka
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7 : 113:	
	or the rest of the Paris, the control of the
<u> </u>	
=	n Winconstitut Constitution
Ru	
×	
o cells: 100 o Detector: 100 l : 5 in/hr tn: 16 mp: 60 , INDIVIDUAL	
100	
100	
AL II II	
thylfo 11s: tector in/hr 16 60 60	
11 s 11 s 11 s 11 s 11 s 11 s 11 s 11	
TO COLUMN	
3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	
The tree is	
Chemical: Dimethylfor Flow rate to cells: I flow rate to Detector: Input attn: I Chart speed: 5 in/hr Lamp: 11.7 Recorder attn: 16 Detector temp: 60 GLOVE LINER, INDIVIDUAL	
VE TTT SEE	
Chemi Flow Input Chart Lamp: Recor Oetec	

			Cn	EMICAL P	ROTECTIVE CLOT	ning r	KODUCI EVALUAI	TON &C	ECORD
1.	DESC	RIPT	ION OF P	PRODUCT E	VALUATED				
			Teflon						
					CODE: 044				
	_				T: Unused, no	visit	le imperfection	ns	
					ab Corp.		-5 -5 -5		
					ON: Inner glo DATE: N/A	ve sne	et Btock		
					7-9 mils				
			RIPTION:						
_									
2.	TEST	METH	IOD		·				
									Road, Austin,
						toioni	zation detecti	on wi	th a 11.70 eV lan
				22-25°C					
				EDIUM:					
				YSTEM:	N <sub>2</sub> l inch cell wa	5 1122	Deterror Ter	Derst.	17e = 600
					F739 METHOD:				
	•								·
L '	CHAI	IENGE	CHEMIC	AL	1	:	COMPONENT 2	:	3
					thylformamide		N/A	;_	N/A
				(i): <u>68-1</u>	2-2	<b>:</b>	N/A	— <u>:</u> -	N/A
			(IF MI		inckrodt	— <u>:</u> —	N/A N/A	:-	N/A N/A
	2. 1 3. 1 4. 1 5. 5	NUMBER BREAKT IN DE STEADY	THROUGH TECTABL	TIME: E LIMIT PERMEATI	7 TED: One (Run 2.5 minutes .29 ppm ON RATE 40.42 mils		m <sup>2</sup> *hr)		
				POINTS					
			TIME	:	CONCENTRATIO	N :	CONCENTRATIO	)N :	CONCENTRATION
				:		<u>:</u>		:_	
		•		:		:		:_	
		·	<del></del>	<u>:</u>		<u></u>		<u>:</u> _	
		: —		<del></del>				<del>:</del> -	
	_	· —				<del></del>		<del></del>	
		<b>:</b>		<del></del>	<del></del>	<del></del> :	<del></del>	<del></del>	
		·. —		<del></del>		:		<del></del> -	
			<del>,</del>	:		:		:	
	1	0		:		:		:	
	8. C	THER	OBSERVA	TIONS: _					
	COIM	CE OF	DATA						
5 <b>.</b>	20 Ok						January 28, 19		

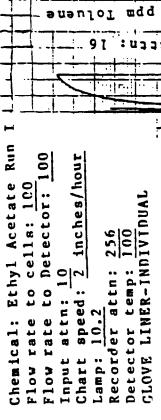
## Dimethylformamide Run III

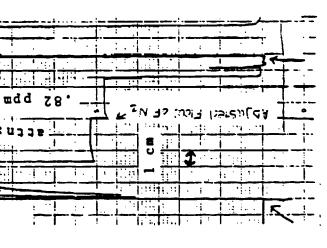


Cimethylformamide charged into cells

345676 T 12344 T 1234	: PROTECTIVE MA : CONDITION BEH : MANUFACTURER: : PRODUCT IDENT : LOT OR MANUFA: : NOMINAL THICH: : DESCRIPTION:  EST METHOD  TESTING LABOUM ANALYTICAL ME TEMPERATURE: COLLECTION ME COLLECTION SE OTHER CONDITE  TEVIATIONS FOR THE CONDITE  CHEM NAME (S) CAS NUMBER (S) CONC. (IF MIXED	Chemfab Ccr IIFICATION: II ACTURER DATE: KNESS: 7-9 mi  RATORY: Texas ETHOD: Contin 22-25°C EDIUM: N2 YSTEM: N2 IONS: 1 inch ROM ASTM F739 AL 1  : Ethyl Acet ): 141-78-6	used, no vis p. nner glove s N/A  1  Research lns uous photoic  cell was us METHOD: Flo	stitute, 9063 Bonization detection	ee Caves tion wit emperatu	re = 100C.
3455676 T 12334567 12334 T 12334	: CONDITION BEE : MANUFACTURER: : PRODUCT IDENT : LOT OR MANUFA: : NOMINAL THICH : DESCRIPTION:  EST METHOD  TESTING LABOU ANALYTICAL ME TEMPERATURE: COLLECTION ME COLLECTION SE OTHER CONDITE DEVIATIONS FOR THE CONDITE  CHEM NAME (S) CAS NUMBER (S) CONC. (IF MIX.) CHEMICAL SOUTH	Chemfab Ccr Chemfab Ccr Chemfab Ccr CTFICATION: I ACTURER DATE: KNESS: 7-9 mi  RATORY: Texas ETHOD: Contin 22-25°C EDIUM: N2 YSTEM: N2 IONS: 1 inch ROM ASTM F739 AL 1  : Ethyl Acet ): 141-78-6 X) N/A	used, no vis p. nner glove s N/A  1  Research lns uous photoic  cell was us METHOD: Flo	stitute, 9063 Bonization detection detection detection detection detection detection in the second s	ee Caves tion wit emperatu	h 10.20 eV lamp  ire = 100C.  3  N/A  N/A
45676 T 1234567. 4 1234	: MANUFACTURER: : PRODUCT IDENT : LOT OR MANUFA : NOMINAL THICH : DESCRIPTION:  EST METHOD  . TESTING LABOUM . ANALYTICAL ME . TEMPERATURE: . COLLECTION MI . COLLECTION ST . OTHER CONDITE . DEVIATIONS FOR THE CONDITE . CHEM NAME (S) . CAS NUMBER (S) . CONC. (IF MIX. CHEMICAL SOUR	Chemfab Ccr IIFICATION: II ACTURER DATE: KNESS: 7-9 mi  RATORY: Texas ETHOD: Contin 22-25°C EDIUM: N2 YSTEM: N2 IONS: 1 inch ROM ASTM F739 AL 1  : Ethyl Acet ): 141-78-6 X) N/A	nner glove s N/A  1  Research lns uous photoic  cell was us METHOD: Flo	stitute, 9063 Bonization detection detection detection detection detection detection in the second s	ee Caves tion wit emperatu	h 10.20 eV lamp  ire = 100C.  3  N/A  N/A
5676 T 1234567.	: PRODUCT IDENT : LOT OR MANUFA : NOMINAL THICH : DESCRIPTION:  EST METHOD  . TESTING LABOR . ANALYTICAL ME . TEMPERATURE: . COLLECTION ME . COLLECTION SE . OTHER CONDITE . DEVIATIONS FOR THE CONDITE . CHEM NAME (S) . CAS NUMBER (S) . CONC. (IF MIX. CHEMICAL SOUR	RATORY: Texas  RATORY: Texas  ETHOD: Contin  22-25°C  EDIUM: N2  YSTEM: N2  IONS: 1 inch  ROM ASTM F739  AL 1  : Ethyl Acet ): 141-78-6  X) N/A	nner glove s N/A  1  Research Ins uous photoic  cell was us METHOD: Flo	stitute, 9063 Bonization detection detection detection detection Trace was 100 COMPONENT 2  N/A  N/A  N/A	emperatu	h 10.20 eV lamp  ire = 100C.  3  N/A  N/A
676 T 1234567.	: LOT OR MANUFA: : NOMINAL THICK : DESCRIPTION:  EST METHOD  . TESTING LABOR . ANALYTICAL ME . TEMPERATURE: . COLLECTION ME . COLLECTION SE . OTHER CONDITE . DEVIATIONS FOR SEPARATIONS FOR S	RATORY: Texas ETHOD: Contin 22-25°C EDIUM: N2 YSTEM: N2 IONS: 1 inch ROM ASTM F739 AL 1  : Ethyl Acet ): 141-78-6 X) N/A	Research Insuous photoic  cell was us METHOD: Flo	stitute, 9063 Bonization detection detection detection detection Trace was 100 COMPONENT 2  N/A  N/A  N/A	emperatu	h 10.20 eV lamp  ire = 100C.  3  N/A  N/A
76 T 1234567.	: NOMINAL THICK : DESCRIPTION:  EST METHOD  . TESTING LABOR . ANALYTICAL ME . TEMPERATURE: . COLLECTION ME . COLLECTION SE . OTHER CONDITE . DEVIATIONS FOR THE CONDITE . CHEM NAME (S) . CAS NUMBER (S) . CONC. (IF MIX. CHEMICAL SOUR	RATORY: Texas ETHOD: Contin 22-25°C EDIUM: N2 YSTEM: N2 IONS: 1 inch ROM ASTM F739 AL 1 : Ethyl Acet ): 141-78-6 X) N/A	Research lns uous photoic  cell was us METHOD: Flo	component 2  N/A  N/A  N/A	emperatu	h 10.20 eV lamp  ire = 100C.  3  N/A  N/A
6 T 1234567. T 1234	EST METHOD  TESTING LABOR ANALYTICAL ME TEMPERATURE: COLLECTION ME COLLECTION SE OTHER CONDITE DEVIATIONS FOR THE CHEMICAL CHEM NAME (s) CAS NUMBER (s) CONC. (IF MIX.)	RATORY: Texas ETHOD: Contin 22-25°C EDIUM: N <sub>2</sub> YSTEM: N <sub>2</sub> IONS: 1 inch ROM ASTM F739 AL 1 : Ethyl Acet ): 141-78-6 X) N/A	Research lns uous photoic  cell was us METHOD: Flo	component 2  N/A  N/A  N/A	emperatu	h 10.20 eV lamp  ire = 100C.  3  N/A  N/A
. Ti 12344567.	EST METHOD  TESTING LABOR ANALYTICAL ME TEMPERATURE: COLLECTION ME COLLECTION SE OTHER CONDITE DEVIATIONS FOR HALLENGE CHEMICAL CHEM NAME(S) CAS NUMBER(S) CONC. (IF MIX.	ETHOD: Contin  22-25°C  EDIUM: N <sub>2</sub> YSTEM: N <sub>2</sub> IONS: 1 inch  ROM ASTM F739  AL 1  : Ethyl Acet ): 141-78-6  X) N/A	cell was us METHOD: Flo	component 2  N/A  N/A  N/A	emperatu	h 10.20 eV lamp  ire = 100C.  3  N/A  N/A
1 2 3 4 5 6 7.	TESTING LABOR ANALYTICAL ME TEMPERATURE: COLLECTION ME COLLECTION ST OTHER CONDITE TEVLATIONS FOR HALLENGE CHEMICAL CHEM NAME(S) CAS NUMBER(S) CONC. (IF MIX CHEMICAL SOUR	ETHOD: Contin  22-25°C  EDIUM: N <sub>2</sub> YSTEM: N <sub>2</sub> IONS: 1 inch  ROM ASTM F739  AL 1  : Ethyl Acet ): 141-78-6  X) N/A	cell was us METHOD: Flo	component 2  N/A  N/A  N/A	emperatu	h 10.20 eV lamp  ire = 100C.  3  N/A  N/A
2 3 4 5 6 7 1 2 3 4 · Ti 1 2 3 4	. ANALYTICAL ME . TEMPERATURE: . COLLECTION ME . COLLECTION SE . OTHER CONDITE . DEVIATIONS FOR THE CHEMICAL . CHEM NAME (s) . CAS NUMBER (s) . CONC. (IF MIX. CHEMICAL SOUR	ETHOD: Contin  22-25°C  EDIUM: N <sub>2</sub> YSTEM: N <sub>2</sub> IONS: 1 inch  ROM ASTM F739  AL 1  : Ethyl Acet ): 141-78-6  X) N/A	cell was us METHOD: Flo	component 2  N/A  N/A  N/A	emperatu	h 10.20 eV lamp  ire = 100C.  3  N/A  N/A
3 4 5 6 7 1 2 3 4 · Ti 1 2 3 4	TEMPERATURE: COLLECTION MI COLLECTION SY OTHER CONDITY DEVIATIONS FOR HALLENGE CHEMICA CHEM NAME(S) CAS NUMBER(& CONC. (IF MIX CHEMICAL SOUR	22-25°C EDIUM: N <sub>2</sub> YSTEM: N <sub>2</sub> IONS: 1 inch ROM ASTM F739 AL 1 : Ethyl Acet ): 141-78-6 X) N/A	cell was us METHOD: Flo	component 2  N/A  N/A  N/A	emperatu cz/min-	3 N/A N/A
1 2 3 4 · Ti 2 3 4	COLLECTION MI COLLECTION SY OTHER CONDITY DEVIATIONS FOR HALLENGE CHEMICA CHEM NAME(S) CAS NUMBER(S CONC. (IF MIX CHEMICAL SOUR	EDIUM: N <sub>2</sub> YSTEM: N <sub>2</sub> IONS: 1 inch ROM ASTM F739  AL 1  : Ethyl Acet ): 141-78-6 X) N/A	METHOD: Flo	COMPONENT 2  N/A  N/A  N/A	ee/min-	3 N/A N/A
5 6 7. 1 2 3 4 . Ti 2 3 4	COLLECTION SY OTHER CONDITY DEVIATIONS FOR HALLENGE CHEMICA CHEM NAME(s) CAS NUMBER(s CONC. (IF MIX CHEMICAL SOUR	YSTEM: N <sub>2</sub> IONS: 1 inch ROM ASTM F739  AL 1  : Ethyl Acet ): 141-78-6 X) N/A	METHOD: Flo	COMPONENT 2  N/A  N/A  N/A	ee/min-	3 N/A N/A
67. 1 22 33 4	OTHER CONDITY DEVIATIONS FOR THE CHEMICAL SOURCE CHEMICAL SOURCE CONDITY OF THE CHEMICAL SOUR	IONS: 1 inch  ROM ASTM F739  AL 1  : Ethyl Acet ): 141-78-6  X) N/A	METHOD: Flo	COMPONENT 2  N/A  N/A  N/A	ee/min-	3 N/A N/A
7. 1 2 3 4 . T	LEVIATIONS FOR CHEMICAL CHEM NAME (s) CAS NUMBER (s) CONC. (IF MIX. CHEMICAL SOUR	ROM ASTM F739  al	METHOD: Flo	COMPONENT 2  N/A  N/A  N/A	ee/min-	3 N/A N/A
1 2 3 4 . Ti	. CHEM NAME (s) . CAS NUMBER(s . CONC. (IF MIX . CHEMICAL SOU	Ethyl Acet ): 141-78-6 X) N/A	ate :	N/A N/A N/A		3 N/A N/A
1 2 3 4 . Ti	. CHEM NAME(s) . CAS NUMBER(s . CONC. (IF MIX . CHEMICAL SOUR	: Ethyl Acet ): 141-78-6 X) N/A	ate :	N/A N/A N/A		N/A N/A
2 3 4 . Ti 1 2 3	. CAS NUMBER(&. CONC. (IF MIX. CHEMICAL SOUT	): $\frac{141-78-6}{N/A}$		N/A N/A		N/A
3 4 1. T: 1 2 3 4	. CONC. (IF MIX. CHEMICAL SOUT	$X) \overline{N/A}$		N/A	:_	
4 1. T: 1 2 3 4	. CHEMICAL SOUT				<u>:</u> _	N/A
. T: 1 2 3 4		RCE: EM Science	<del></del> :-	N/A		
1 2 3 4	EST RESULTS					N/A
5 6	DATE TESTED: NUMBER OF SAME BREAKTHROUGH MIN DETECTABLE STEADY STATE I SAMPLE THICKNI SELECTED DATA	PLES TESTED: TIME: 2.5 min E LIMIT .87 p PERMEATION RAT ESS: 7 mils	utes	ıg/cm²/hr		
	TIME	: CONC	ENTRATION	: CONCENTRAT	ion :	CONCENTRATION
	2.	<del></del>		:	<del></del> -	
	3.	:	· · · · · · · · · · · · · · · · · · ·	;	:	
	4.	:	<del></del>	•	:	
	5.	:		•	:	
	6.	:		:	:	
	7.	;		:		
	8.	:		:		
	9.	•		:	:	
	10.	•		:	:	
Ą	OTHER OBSERVA	TIONS				
J	- UILL OBBLIVA					
5. S	OURCE OF DATA				-	

## Ethyl Acetate Run

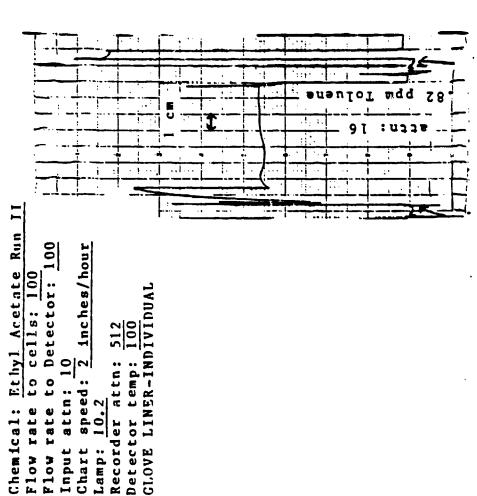




Ethyl Acetate charged into cells

	2: 3:	PROTECTIVE MATERIAL CODE: 0 CONDITION BEFORE TEST: Unu	والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع	lons
		PRODUCT IDENTIFICATION: In		
		LOT OR MANUFACTURER DATE: N	/A	
		NOMINAL THICKNESS: 7 mils		
	8:	DESCRIPTION:		
2.	TES	ST METHOD		
		TESTING LABORATORY: Texas R		
		ANALYTICAL METHOD: Continu	ous photoionization detect	tion with a 10.20 eV lamp.
		TEMPERATURE: 22-25°C		
	4.	COLLECTION MEDIUM: N2		
				T
		OTHER CONDITIONS: 1 inch DEVIATIONS FROM ASTM F739 M		
3.	CHA	LLENGE CHEMICAL 1	: COMPONENT 2	: 3
	1.	CHEM NAME(s) : Ethyl Aceta	:	:\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
		CAS NUMBER(s): 141-78-6	: N/A	: N/A
		CONC. (IF MIX) N/A	: N/A	: N/A
	4.	CHEMICAL SOURCE: EM Science	: N/A	:N/A
	2. 3.	DATE TESTED: 12-17-86  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 minu MIN DETECTABLE LIMIT .89 ppm	tes	
	2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED: OBREAKTHROUGH TIME: 2.5 minu MIN DETECTABLE LIMIT .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils	tes	
	2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED: 0 BREAKTHROUGH TIME: 2.5 minu MIN DETECTABLE LIMIT .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A	269.64 ug/cm <sup>2</sup> *hr	
	2. 3. 4. 5. 6.	NUMBER OF SAMPLES TESTED: 0 BREAKTHROUGH TIME: 2.5 minu MIN DETECTABLE LIMIT .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A	tes	ION : CONCENTRATION
	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: 0 BREAKTHROUGH TIME: 2.5 minu MIN DETECTABLE LIMIT .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A	269.64 ug/cm <sup>2</sup> *hr	ION : CONCENTRATION :
	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: OBREAKTHROUGH TIME: 2.5 minumin Detectable Limit .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME: CGNCE 1.	269.64 ug/cm <sup>2</sup> *hr	ION : CONCENTRATION : : : : : : : : : : : : : : : : : : :
	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: OBREAKTHROUGH TIME: 2.5 minu MIN DETECTABLE LIMIT .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME : CCNCE  1. : 2. : 3. : 4. :	269.64 ug/cm <sup>2</sup> *hr	ION : CONCENTRATION : : :
	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: OBREAKTHROUGH TIME: 2.5 minumin Detectable Limit .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME: CGNCE 1. : 2. : 3. : 4. : 5. :	269.64 ug/cm <sup>2</sup> *hr	ION : CONCENTRATION : : : :
	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: OBREAKTHROUGH TIME: 2.5 minu MIN DETECTABLE LIMIT .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME: CGNCE 1. : 2. : 3. : 4. : 5. : 6. :	269.64 ug/cm <sup>2</sup> *hr	ION : CONCENTRATION : : : : :
	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: OBREAKTHROUGH TIME: 2.5 minu MIN DETECTABLE LIMIT .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME : CGNCE 1. : : : : : : : : : : : : : : : : : : :	269.64 ug/cm <sup>2</sup> *hr	ION: CONCENTRATION:
	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: OBREAKTHROUGH TIME: 2.5 minumin Detectable Limit .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME: CGNCE 1. : 2. : 3. : 4. : 5. : 6. :	269.64 ug/cm <sup>2</sup> *hr	ION : CONCENTRATION : : : : : :
	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: OBREAKTHROUGH TIME: 2.5 minumin Detectable Limit .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME : CGNCE 1. : : : : : : : : : : : : : : : : : : :	269.64 ug/cm <sup>2</sup> *hr	ION : CONCENTRATION : : : : : :
	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: OBREAKTHROUGH TIME: 2.5 minu MIN DETECTABLE LIMIT .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME: CGNCE 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	269.64 ug/cm <sup>2</sup> *hr	ION: CONCENTRATION: : : : : : : : : : : : : : : : : : :
	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: OBREAKTHROUGH TIME: 2.5 minumin Detectable Limit .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME : CGNCE  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	269.64 ug/cm <sup>2</sup> *hr	ION: CONCENTRATION : : : : : : : : : : : : : : : : : : :
	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: OBREAKTHROUGH TIME: 2.5 minumin Detectable Limit .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME: CGNCE 1. : : : : : : : : : : : : : : : : : : :	269.64 ug/cm <sup>2</sup> *hr	ION: CONCENTRATION: :::::::::::::::::::::::::::::::::::
·•	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: OBREAKTHROUGH TIME: 2.5 minumin Detectable Limit .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME: CGNCE  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :  OTHER OBSERVATIONS:	269.64 ug/cm <sup>2</sup> *hr	
•	2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: OBREAKTHROUGH TIME: 2.5 minumin Detectable Limit .89 ppm STEADY STATE PERMEATION RATE SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME: CGNCE  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :  OTHER OBSERVATIONS:	tes  269.64 ug/cm <sup>2</sup> *hr  NTRATION : CONCENTRAT: : : : : : : : : : : : : : : : : : :	

## Ethyl Acetate Run II



Ethyl Acetate charged into cells Swit

2:	TYPE: Teflon			
•				
	CONDITION BEFORE TEST: Unused, n	o visible imperfection	กร	
4:	MANUFACTURER: Chemfab Corp.			
	PRODUCT IDENTIFICATION: Inner gl	ove sheet stock		
	LOT OR MANUFACTURER DATE: N/A			
	NOMINAL THICKNESS: 7-9 mil			
8:	DESCRIPTION:			
TE	ST METHOD			
1.	TESTING LABORATORY: Texas Researc	h Institute, 9063 Bee	Caves	Road. Austin. '
2.	ANALYTICAL METHOD: Continuous ph			
	TEMPERATURE: 22-25°C			
4.	COLLECTION MEDIUM: No			
5.	COLLECTION SYSTEM: N2			
	OTHER CONDITIONS: 1 inch cell w	as used./Detector Ten	peratur	e = 100C.
7.	DEVIATIONS FROM ASTM F739 METHOD:	Flow rate was 100 c	e/min-	
	ALIENCE CHEMICAL 1	: COMPONENT 2	:	.3
1.	CHEM NAME(s): Ethyl Acetate		· ·	N/A
	CAS NUMBER(s): 141-78-6	: N/A	:	N/A
	CONC. (IF MIX) N/A	: N/A	:	N/A
4.	CHENICAL SOURCE: EN Science	:: N/A	:	N/A
1.	DATE TESTED: 12-17-86			
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: One (RubreakThrough Time: 2.5 minutes MIN DETECTABLE LIMIT .90 ppm STEADY STATE PERMEATION RATE 258 SAMPLE THICKNESS: 7 mils			
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: One (RubreakThrough Time: 2.5 minutes MIN DETECTABLE LIMIT .90 ppm STEADY STATE PERMEATION RATE 258			
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: One (Rubreakthrough time: 2.5 minutes) MIN DETECTABLE LIMIT .90 ppm STEADY STATE PERMEATION RATE 258 SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME : CONCENTRATI	.24 ug/cm <sup>2</sup> /hr	N :	CONCENTRATION
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: One (Rubreakthrough Time: 2.5 minutes MIN DETECTABLE LIMIT .90 ppm STEADY STATE PERMEATION RATE 258 SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A	.24 ug/cm <sup>2</sup> /hr	N :	CONCENTRATION
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: One (Rubreakthrough time: 2.5 minutes) MIN DETECTABLE LIMIT .90 ppm STEADY STATE PERMEATION RATE 258 SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME : CONCENTRATI 1.	.24 ug/cm <sup>2</sup> /hr	N :	CONCENTRATION
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: One (RubreakThrough Time: 2.5 minutes MIN DETECTABLE LIMIT .90 ppm STEADY STATE PERMEATION RATE 258 SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME: CONCENTRATI 1. : 2. :	.24 ug/cm <sup>2</sup> /hr	N :	CONCENTRATION
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: One (Rubres of Sample Limit .90 ppm STEADY STATE PERMEATION RATE .258 SAMPLE THICKNESS: 7 mils SELECTED DATA POINTS N/A  TIME : CONCENTRATI  1. : 2. : 3. :	.24 ug/cm <sup>2</sup> /hr	N :	CONCENTRATION
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: One (Rubres of Samples)  MIN DETECTABLE LIMIT .90 ppm  STEADY STATE PERMEATION RATE 258  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATI  1. : 2. : 3. : 4. :	.24 ug/cm <sup>2</sup> /hr	N : : : : : : : : : : : : : : : : : : :	CONCENTRATION
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: One (Rubres of Samples)  NIN DETECTABLE LIMIT .90 ppm  STEADY STATE PERMEATION RATE 258  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATI  1. : 2. : 3. : 4. : 5. :	.24 ug/cm <sup>2</sup> /hr	N : : : : : : : : : : : : : : : : : : :	CONCENTRATION
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: One (Rubres of Sample Time: 2.5 minutes of Steady State Permeation Rate 258 Sample Thickness: 7 mils selected Data Points	.24 ug/cm <sup>2</sup> /hr	N : : : : : : : : : : : : : : : : : : :	CONCENTRATION
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: One (Rubres of Samples)  MIN DETECTABLE LIMIT .90 ppm  STEADY STATE PERMEATION RATE _258  SAMPLE THICKNESS: _7 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATI  1	.24 ug/cm <sup>2</sup> /hr	N : : : : : : : : : : : : : : : : : : :	CONCENTRATION
2. 3. 4. 5.	NUMBER OF SAMPLES TESTED: One (Rubres of Samples)  MIN DETECTABLE LIMIT .90 ppm  STEADY STATE PERMEATION RATE _258  SAMPLE THICKNESS: _7 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATI  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :	.24 ug/cm <sup>2</sup> /hr	N : : : : : : : : : : : : : : : : : : :	CONCENTRATION
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: One (Rubres of Samples)  NIN DETECTABLE LIMIT .90 ppm  STEADY STATE PERMEATION RATE 258  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATI  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	.24 ug/cm <sup>2</sup> /hr	N : : : : : : : : : : : : : : : : : : :	CONCENTRATION
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: One (Rubres of Samples)  MIN DETECTABLE LIMIT .90 ppm  STEADY STATE PERMEATION RATE _258  SAMPLE THICKNESS: _7 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATI  1	.24 ug/cm <sup>2</sup> /hr	N : : : : : : : : : : : : : : : : : : :	CONCENTRATION
2. 3. 4. 5. 6. 7.	NUMBER OF SAMPLES TESTED: One (Rubres of Samples)  NIN DETECTABLE LIMIT .90 ppm  STEADY STATE PERMEATION RATE 258  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATI  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	.24 ug/cm <sup>2</sup> /hr	N : : : : : : : : : : : : : : : : : : :	CONCENTRATION

## Ethyl Acetate Run III

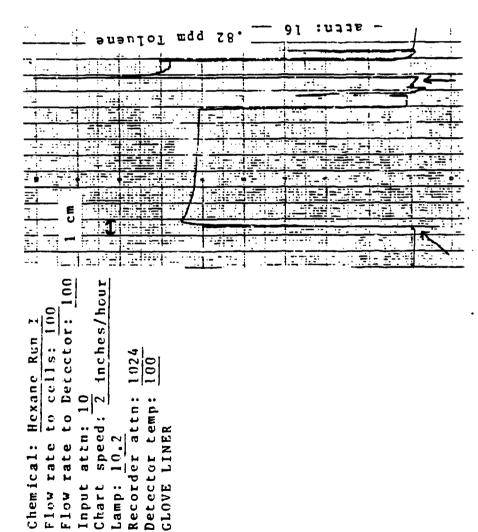
Chemical: Ethyl Acetate Run III Flow rate to Detector: 100 Chart speed: 2 inches/hour Flow rate to cells: 100 GLOVE LINER-INDIVIDUAL Recorder attn: 256 Detector temp: 100 Input attn: 10

Lamp:

Ethyl Acetate charged into cells

1:	TYPE: Teflon						
2:		ATEKIAL	CODE: 044				
3:	CONDITION BE	FORE TES	T: Unused, no	visibl	e imperfecti	ons	
4:							
5:	PRODUCT IDENT	TIFICATI	ON: Inner glo	ove shee	t etock		
6:	LOT OR MANUF	ACTURER	DATE: N/A				
7:	NOMINAL TRICE	XXESS:	7 mils				
8:	DESCRIPTION:						
TES	ST NETHOD	<del></del>	<del></del>				
1.	TESTING LARO	RATORY:	Texas Research	n Instit	ute. 9063 Be	e Caves	Road, Austin,
2.	ANALYTICAL M	ETHOD:	Continuous pho	toionia	ation detect	ion wit	h a 10.20 eV 1
	TEMPERATURE:						
4.					<del></del>		
	COLLECTION S'			. ———			
			l inch cell w	s used.	/ Detector	Tempera	ture = 100C.
			F739 METHOD:				
TRA	ALLENGE CHEMIC.	47	1	: 0	OMPONENT 2	•	3
CHA	LIENGE CHEMIC.	ML.	•	:	OMFUNENT 2	:	•
1-	CHEM NAME(s)	: Hexa	ine	:	N/A	:	N/A
2.	CAS NUMBER(s	): <del>110-</del>	-54-3	_:	N/A	:	N/A
3.	CONC. (IF MI	K) K/A	<del></del>		N/A	:	N/A
4.	CHEMICAL SOUR	RCE: Aldr	ich	:	E/A		N/A
2. 3. 4. 5. 6.	BREAKTHROUGH MIN DETECTABLE STEADY STATE : SAMPLE THICKN	PLES TES TIME: 2 E LIMIT PERMEATI ESS:	TED: One (Rust) 2.5 minutes 9.12 ppm ON RATE 1898 7 mils		T.		
/.	SELECTED DATA	POINTS	F./A		<del></del>	<del> </del>	
	TIME	:	CONCENTRATI	: ис	<b>CONCENTRATI</b>	. ио	CONCENTRATION
	1.	<u> </u>	<del></del>		· · · · · · · · · · · · · · · · · · ·	<u> </u>	
	2.	<u>:</u>		:		:	
	3.	:		:		<u>:</u>	
	4.	:		<u>:</u>	<del></del>	:	
	5.	<u>:</u>		<u> </u>	<del> </del>	:	
	6.	<u>:</u>	<del></del>	:			
	7.	:		<u>:</u>	<del></del>	<u> </u>	
	8.	<u> :</u>		<u>:</u>		<u>:</u>	
	9.	:	<del></del>	:_	<del> </del>	<u>:</u>	
	10			:			
	OTHER OBSERVA	TIONS:					
8.	OTHER OBSERVA						
8.	OTHER OBSERVA						
	URCE OF DATA					<del></del>	

## Hexane Run I



Hexane charged into cells to stan and

اد د د

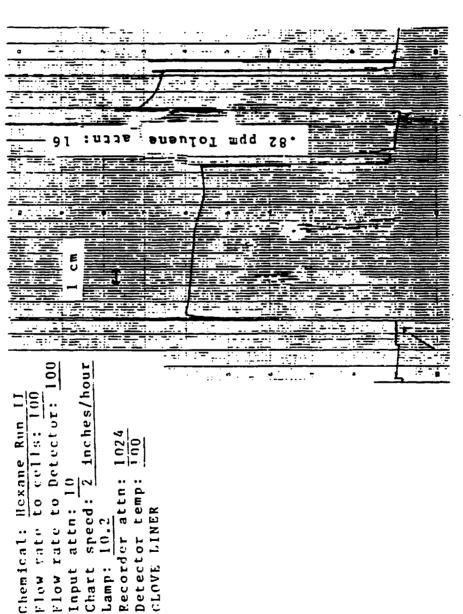
2:	TYPE: leflon				
	BRATECT ILE MATEL				
		IAL CODE: 044			
3:	CONDITION BEFORE	TEST: Unused,	no visible imperfe	ctions	
	MANUFACTURER: CH				
	PRODUCT IDENTIFIC		love sheet stock		<del></del>
	LOT OR MANUFACTUE			······································	<del></del>
	NOMINAL THICKNESS		<del></del>	<del> </del>	<del></del>
	DESCRIPTION:	, <u>, , , , , , , , , , , , , , , , , , </u>		<del></del>	· · · · · · · · · · · · · · · · · · ·
٠.					
TES	ST METHOD				
			ch Institute, 9063		
			hotoionization det	ection with	a 10.20 eV la
	TEMPERATURE: 22-				
	COLLECTION MEDILE				
5.	COLLECTION SYSTE	M: N <sub>2</sub>	· · · · · · · · · · · · · · · · · · ·		
6.	OTHER CONDITIONS	: linch cell	was used. / Detect	or Temperati	re = 100C.
7.	DEVIATIONS FROM	ASTM F739 METHOD	: Flow rate was 1	00 cc/min.	
CHA	allenge Chemical	1	: COMPONENT	2 :	3
1.	CHEM NAME(s):	Hexane	: N/A	:	N/A
2.	CAS NUMBER(s):	110-54-3	N/A		N/A
3.	CONC. (IF MIX)	ν/Δ	N/A	<del></del> :	N/A
	CHEMICAL SOURCE:		· N/A	<del></del> :	N/A
TES	ST RESULTS				
_	<b></b>				
	DATE TESTED: 12-			····	<del></del>
	NUMBER OF SAMPLES		un II)		
3.	BREAKTHROUGH TIME	: · 2.5 minutes			
4.	MIN DETECTABLE LIN	MIT 9.60 ppm			
5.	STEADY STATE PERM	EATION RATE 1838	ug/cm²/hr		
	SAMPLE THICKNESS:				<del></del>
	SELECTED DATA POI				
	TIME :	CONCENTRAT	ION : CONCENTR	ATION :	CONCENTRATION
	2.		<del></del>	<u> </u>	<del></del>
			<u> </u>	<u> </u>	
	3.		<u> </u>	<u> </u>	<del> </del>
	4:	<del></del>	<u> </u>	<u>:</u>	
	5:		<u> </u>	:	<u></u>
	6:		:	:	
	7		:	:	
	8. :		:	:	
	9.	<del></del>	:	:	<del></del>
	10.		:		
8.	OTHER OBSERVATION	S:			
501	URCE OF DATA				

## Hexane Run II

Input attn: 10

Lamp: 10.2

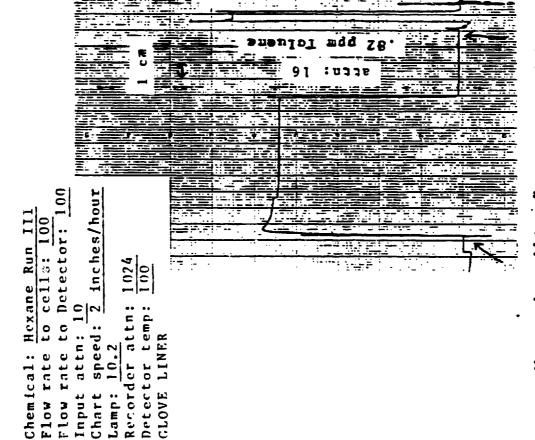
CLOVE LINER



Hexane charged Into cells

	2:	TYPE: Teflon PROTECTIVE MATER				
		CONDITION BEFORE MANUFACTURER: C		, no visibl	e imperfections	
		PRODUCT IDENTIFI		glove shee	t stock	
	6:	LOT OR MANUFACTU	TREK DATE: N/A			
		NOMINAL THICKNES DESCRIPTION:	S: 7 mils			
2.	TES	T METHOD		<del></del>		
			IFY. Tayas Rese	erch Inetii	ute 9063 Ree Cay	es Rozd, Austin, TX
						ith a 10.20 eV lamp.
	_	TEMPERATURE: 22-				
		COLLECTION MEDIC				
				l wrs used	/ Detector Tempe	rature = 100C.
	7.	DEVIATIONS FROM	ASTI F739 METHO	D: Flow r	ate was 100 cc/mi	n•
3.	CHA	LIENCE CHEMICAL	1	: C	OMIONENT 2 :	3
		CHEM NAME(s):		:_	N/A :	r/a
		CAS NIMBER(s): CONC. (IF MIX)		:	N/A :	N/A N/A
		CHEMICAL SOURCE:		:	N/A	N/A
i .	TES	T RESULTS				
		DATE TESTED: 12-		<del></del>		
		NUMBER OF SAMPLES BREAKTHROUGH TIME		(Run III)	<del></del>	<del></del>
		MIN DETECTABLE LI			*	
		STEADY STATE PERM		10 ug/cm <sup>2</sup> /h	ΙΓ	
	υ.	SAMPLE THICKNESS:		<del></del>		
	7.	SELECTED DATA POI			CONCENTRATION :	CONCENTRATION
	7.	SELECTED DATA POI	CONCENTRA	ATION :	LUNCENTRALIUM :	
		TIME :	CONCENTRA	ATION :	CONCENTRATION:	
		TIME :	CONCENTRA	ATION :	CONCENTRATION:	
		TIME : : : : : : : : : : : : : : : : : : :	CONCENTRA	ATION :	CONCENTRATION:	
		TIME : : : : : : : : : : : : : : : : : : :		ATION :	CONCENTRATION:	
		TIME:		ATION :	CONCENTRATION:	
		TIME : : : : : : : : : : : : : : : : : : :		ATION:	CONCENTRATION	
		TIME:		ATION:	CONCENTRATION	
		TIME : : : : : : : : : : : : : : : : : : :		ATION:	CONCENTRATION	
		TIME: 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :		ATION :	CONCENTRATION	
		TIME:		ATION :	CONCENTRATION	
-	8.	TIME  1		ATION :	CONCENTRATION	
5.	8.	TIME : 1.	NS:			
· .	8.	TIME : 1.	NS:		December 22, 1986.	
Ď.	8.	TIME : 1.	NS:			
;·	8.	TIME : 1.	NS:			

## Hexane Run III



Hexane charged into cells

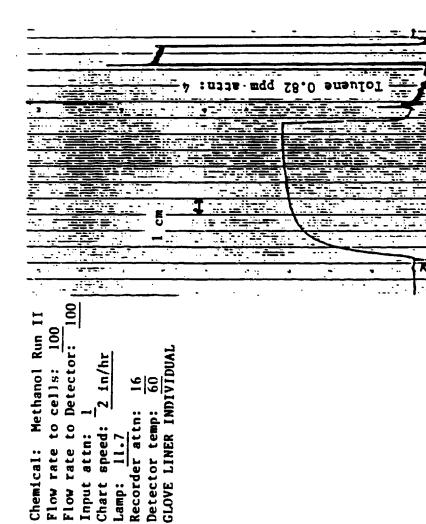
3: 4:	MANUFACTURER	: Chemi	ab Corp.		le imperfection	ons	<del></del>
5:		TIFICAT	ON: Inner	love she	et stock		
<b>5:</b>							<del></del>
7: B:			7-9 m118				
TES	ST METHOD				<del></del>		
1.							Road, Austin
2. 3.				hotolon1	zation detecti	on wit	h a 11.70 eV 1
3. 4.							<del></del>
	COLLECTION S						
	OTHER CONDIT	·		was used	Detector Ten	Deratu	re = 60C.
7.	DEVIATIONS F	ROM ASTM	F739 METHOI	: Flow	rate was 100 c	c/min.	
CH.	LIENCE CHEMIC	AL.	1	:	COMPONENT 2	:	3
	CHEM NAME(s)	. Mask	ana l	:	N/A	:	N/A
	CAS NUMBER(s			;	N/A	:	N/A
3.	CONC. (IF MI	$\hat{X}$ ) $\frac{372}{N/A}$		:	N/A	:-	N/A
	CHEMICAL SOU				N/A		N/A
2. 3. 4. 5.	DATE TESTED: NUMBER OF SAM BREAKTHROUGH MIN DETECTABLE STEADY STATE SAMPLE THICKN SELECTED DATA	PLES TES TIME: E LIMIT PERMEAT ESS: 8	TED: One (F 2.5 minutes .65 ppm ON RATE 20. mils		m <sup>2</sup> *hr)		
•	TIME	:		CION :	ርሳ እነርፕ ሂሞን ለጥ ፣ ረ	N •	CONCENTRATION
	1.	-		:	oo hountant 10	;	A MACHIEN TO
	2	:				:	
	3.			:		:	
	4	<u>:</u>		:		:	
	·	<u></u>		<del></del>			
	<b>0.</b>	<b>.</b>		<u>:</u>	<del></del>	:_	<del></del>
	7.	<u>:</u>				<del></del>	
		— <del>:</del>			<del></del>	<del></del>	
	0	•		<del></del>	·	<del></del>	<del></del>
	9.	:					
	0	<u> </u>		_ <del></del> -			

Chemical Resistance Testing of Chemical: Hetlanol Run I Flow rate to cells: 100 Flow rate to Detector: 100 Input atm: 1 Chart speed: 2 tahl Lamp: 11.1 Recorder atm: 16 Recorder	. Chemical Resistance Test Methanol Ru	
--	--	--

Methanol charged into cells

	1: TY	PE: Teflon					•
		OTECTIVE MATE	ERIAL CODE:	044			
					sible imperfect:	ione	<del></del>
		NUFACTURER:			store imperieux.	20116	<del></del>
				Inner glove	sheet stock	<del></del>	
	6: LO	T OR MANUFAC	TIDES DATE.	N/A	sneet Stock	<del></del>	
		MINAL THICKN					<del></del>
	8: DE	SCRIPTION:	233: 7-9	11.18		<del></del>	
	U. DE.					<del></del>	<del></del>
•	TEST MI	ETHOD					
	1. TES	STING LABORA	TORY: Texas	Research In	stitute, 9063 Be	ee Caves	Food, Austin, TX
	2. ANA	ALYTICAL METI	HOD: Conti	nuous photoi	onization detect	tion wit	h 4 11.70 eV lamp
		MPERATURE: 2					
	4. COI	LLECTION MEDI	IUM: No				
	5. COT	LLECTION SYST	TEM: N2		<del></del>		
				h cell was u	sed./Detector Te	emperatu	ce = 60C.
	7. DE	VIATIONS FROM	ASTM F739	METHOD: F.	ow rate was 100	cc/min-	
•	CHALLE	NGE CHEMICAL		1 :	COMPONENT 2		3
•	Other set.	NOL CHEMICAL			COMPONENT 2		
	1. CHE	EM NAME(s):	Methanol	•	W/A	:	T/A
	2. CAS	S NUMBER(s):	811-98-3	<del></del> :	N/A		N/A
		NC. (IF MIX)		·.	N/A		N/A
		EMICAL SOURCE			N/A		N/A
	2. NUMI 3. BREA 4. MIN 5. STEA 6. SAME	AKTHROUGH TIN DETECTABLE I ADY STATE PEI PLE THICKNESS	ES TESTED:  4E: 2.5 m  LIMIT .64  RMEATION RA  5: 7 mils	ррш .TE <u>15.54</u> (u			
			DINTS N/A				
	7. SELI	ECTED DATA PO	<del></del>				
		ECTED DATA PO	<del></del>	CENTRATION	: CONCENTRATI	ION :	CONCENTRATION
	1		<del></del>	CENTRATION	: CONCENTRATI	ION :	CONCENTRATION
	1. 2.		: CON	CENTRATION	: CONCENTRAT	ION :	CONCENTRATION
	1 2 3		: CON	CENTRATION	: CONCENTRAT	ION:	CONCENTRATION
	1 2 3 4		: CON	CENTRATION	: CONCENTRAT	ION :	CONCENTRATION
	1 2 3 4 5		CON	CENTRATION	: CONCENTRAT	ION:	CONCENTRATION
	1 2 3 4 5		: CON	CENTRATION	: CONCENTRAT	ION :	CONCENTRATION
	1 2 3 4 5 6 7		CON	CENTRATION		ION:	CONCENTRATION
	1 2 3 4 5 6 7 8		CON	CENTRATION	CONCENTRAT		CONCENTRATION
	1 2 3 4 5 6 7 8		CON	CENTRATION		ION :	CONCENTRATION
	1 2 3 4 5 6 7 8		CON	CENTRATION			CONCENTRATION
	1 2 3 4 5 7 8 9 10		CON	CENTRATION			CONCENTRATION
	1 2 3 4 5 7 8 9 10	TIME	CON	CENTRATION			CONCENTRATION
	1	TIME  ER OBSERVATIO	CON	CENTRATION			CONCENTRATION
	1 2 3 4 5 7 8 9 10 8. OTHE	TIME  ER OBSERVATIO  OF DATA	: CON ::::::::::::::::::::::::::::::::::::				CONCENTRATION

## Methanol Run II



Methanol charged into cells

3	: PROTECTIVE MATERIAL COD : CONDITION BEFORE TEST:	Unused, no vis	ible imperfecti	ons	
	: MANUFACTURER: Chemfab : PRODUCT IDENTIFICATION:	Corp.	shook ob ook		
	: LOT OR MANUFACTURER DAT	E: N/A	neer stock		
	: NOMINAL THICKNESS: 7-9				
8	: DESCRIPTION:				
1	TEST METHOD				
1	. TESTING LABORATORY: Tex	as Research Ins	titute, 9063 Be	e Caves Ro	oad, Austin, I
	. ANALYTICAL METHOD: Con	tinuous photoic	nization detect:	ion with a	11.70 eV lar
	. TEMPERATURE: 22-25°C				
4	COLLECTION MEDIUM: N2	<del></del>			
<u>ک</u>	. COLLECTION SYSTEM: N2		-1 0		- 405
7	DEVIATIONS FROM ASTM F7	39 METHOD: Flo	ow rate was 100	cc/min.	- 6UC.
•	FOREIG CHEMICS.	1 :	COMPONENT 2	3	3
1	. CHEM NAME(s): Methano	:	N/A	<b>:</b>	N/A
	. CAS NUMBER(3): 811-98-		N/A		N/A
3	. CONC. (IF MIX) N/A	:	N/A		N/A
4	. CHEMICAL SOURCE: Fisher		N/A	:	N/A
T	EST RESULTS				
1	. DATE TESTED: 1-26-87				
2	. NUMBER OF SAMPLES TESTED	: One (Run III	:)	· · · · · · · · · · · · · · · · · · ·	
3	. BREAKTHROUGH TIME: 2.5	minutes		<del></del>	
4	. MIN DETECTABLE LIMIT .6	5 ppm			
	. STEADY STATE PERMEATION		/cm <sup>2</sup> *hr)		
	. SAMPLE THICKNESS: 7 mil				
,	. SELECTED DATA POINTS N	/A			
	TIME : C	ONCENTRATION	: CONCENTRATIO	ои : а	NCENTRATION
	1. 2. :		<u>:</u>	<u> </u>	
	3.		:	:	
	4. :		<u>:</u>		
	6.		:	<del>:-</del> -	
	7.		:		
	<u> </u>		:		
	8.				
	8. : 9. :			<del></del> -	
	8. 9. 10.		•		
8	8. : : : : : : : : : : : : : : : : : : :		:		

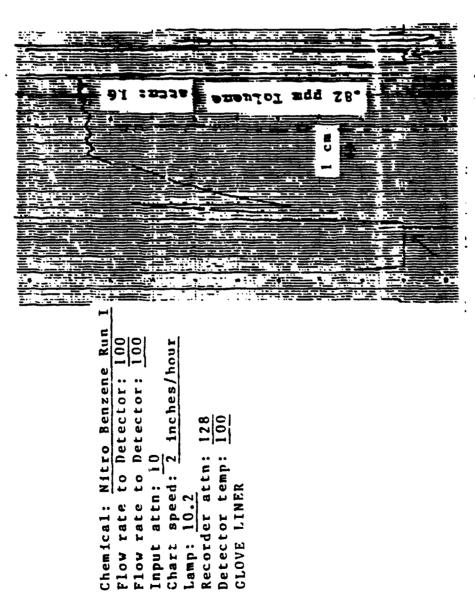
## Methanol Run III

to to to to to to to to to to to to to t
The Toluene 0.82 ppm = margal tolucher
***
0
= 8
4r : 100 : 100 : 100
4r : 100 : 100 : 100
DUAL DUAL
DUAL DUAL
DUAL DUAL
DUAL DUAL
hanol Run ells: 100 etector: 2 in/hr 16 60 60 NDIVIDUAL
hanol Run ells: 100 etector: 2 in/hr 16 60 60 NDIVIDUAL
cells: 100 Detector:  1 2 in/hr n: 16 p: 60 INDIVIDUAL
cells: 100 Detector:  1 2 in/hr n: 16 p: 60 INDIVIDUAL
cells: 100 Detector:  1 2 in/hr n: 16 p: 60 INDIVIDUAL
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cells: 100 Detector:  1 2 in/hr n: 16 p: 60 INDIVIDUAL
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cells: 100 Detector:  1 2 in/hr n: 16 p: 60 INDIVIDUAL
cells: 100 Detector:  1 2 in/hr n: 16 p: 60 INDIVIDUAL
cells: 100 Detector:  1 2 in/hr n: 16 p: 60 INDIVIDUAL
Methanol Run o cells: 100 o Detector:  1 2 in/hr in: 16 mp: 60 , INDIVIDUAL

Methanol charged into cells

	PROTECTIVE MATERIAL							
3:	CONDITION BEFORE TEST: Unused, no visible imperfections							
4:	MANUFACTURER: Chemf	ab Corp.						
	PRODUCT IDENTIFICATI		heet stock					
6:	LOT OR MANUFACTURER	DATE: N/A						
7:	NOMINAL THICKNESS:	7-9 mils						
8:	DESCRIPTION:							
TE	ST METHOD				· · · · · · · · · · · · · · · · · · ·			
1.	TESTING LABORATORY:	Texas Research Ins	titute, 9063 Bee C	aves	Road, Austin,			
	ANALYTICAL METHOD:		nization detection	wit	h a 10.20 eV la			
	TEMPERATURE: 22-25°C							
4.	COLLECTION MEDIUM:	No.						
5.	COLLECTION SYSTEM:	N <sub>2</sub>						
	OTHER CONDITIONS:							
7_	DEVIATIONS FROM ASTM	F739 METHOD: Flo	w rate was 100 cc/	nin-				
CH	ALLENCE CHEMICAL	1 :	COMFONENT 2	:	3			
1.	CHEM NAME(s): Nitro	obenzene :	W/A	•	n/a			
2.	CAS NUMBER(s): 98-9.	5-3	N/A	-;	N/A			
2	CONC. (IF MIX) N/A	· · · · · · · · · · · · · · · · · · ·	N/A	_;_	N/A			
J.								
4. TE	CHEMICAL SOURCE: Mall: ST RESULTS  DATE TESTED: 12-23-86	5	N/A		N/A			
4. TE 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Mall: ST RESULTS  DATE TESTED: 12-23-8 NUMBER OF SAMPLES TES: BREAKTHROUGH TIME: 2 MIN DETECTABLE LIMIT STEADY STATE PERMEATIC	6 TED: One (Run I) .50 minutes .13 ppm ON RATE 57.18 ug/						
4. TE 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Mall: ST RESULTS  DATE TESTED: 12-23-80 NUMBER OF SAMPLES TEST BREAKTHROUGH TIME: 2 MIN DETECTABLE LIMIT	6 TED: One (Run I) .50 minutes .13 ppm ON RATE 57.18 ug/						
4. TE 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Mall: ST RESULTS  DATE TESTED: 12-23-86 NUMBER OF SAMPLES TES: BREAKTHROUGH TIME: 2 MIN DETECTABLE LIMIT STEADY STATE PERMEATIC SAMPLE THICKNESS: 7 SELECTED DATA POINTS  TIME :	6 TED: One (Run I) .50 minutes .13 ppm ON RATE 57.18 ug/ mils N/A						
4. TE 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Mall: ST RESULTS  DATE TESTED: 12-23-86 NUMBER OF SAMPLES TEST BREAKTHROUGH TIME: 2 MIN DETECTABLE LIMIT STEADY STATE PERMEATIC SAMPLE THICKNESS: 7 SELECTED DATA POINTS  TIME: 1.	FED: One (Run I) 50 minutes 13 ppm ON RATE 57.18 ug/	cm <sup>∠</sup> *hr		N/A			
4. TE 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Mall: ST RESULTS  DATE TESTED: 12-23-86 NUMBER OF SAMPLES TES: BREAKTHROUGH TIME: 2 MIN DETECTABLE LIMIT STEADY STATE PERMEATIC SAMPLE THICKNESS: 7 SELECTED DATA POINTS  TIME :	FED: One (Run I) 50 minutes 13 ppm ON RATE 57.18 ug/	cm <sup>∠</sup> *hr	:	N/A			
4. TE 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Mall:  ST RESULTS  DATE TESTED: 12-23-86 NUMBER OF SAMPLES TEST BREAKTHROUGH TIME: 2 MIN DETECTABLE LIMIT STEADY STATE PERMEATIC SAMPLE THICKNESS: 7 SELECTED DATA POINTS  TIME : 1. : 2. :	FED: One (Run I) 50 minutes 13 ppm ON RATE 57.18 ug/	cm <sup>∠</sup> *hr		N/A			
4. TE 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Mall:  ST RESULTS  DATE TESTED: 12-23-80 NUMBER OF SAMPLES TEST BREAKTHROUGH TIME: 2 MIN DETECTABLE LIMIT STEADY STATE PERMEATIC SAMPLE THICKNESS: 7 SELECTED DATA POINTS  TIME: 1. : 2. : 3. :	FED: One (Run I) 50 minutes 13 ppm ON RATE 57.18 ug/	cm <sup>2</sup> *hr : CONCENTRATION:	:	N/A			
4. TE 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Mall:  ST RESULTS  DATE TESTED: 12-23-86 NUMBER OF SAMPLES TES: BREAKTHROUGH TIME: 2 MIN DETECTABLE LIMIT STEADY STATE PERMEATIC SAMPLE THICKNESS: 7 SELECTED DATA POINTS  TIME: 1. : 2. : 3. : 4. :	FED: One (Run I) 50 minutes 13 ppm ON RATE 57.18 ug/	cm2*hr : CONCENTRATION : :	:::::::::::::::::::::::::::::::::::::::	N/A			
4. TE 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Mall:  ST RESULTS  DATE TESTED: 12-23-80 NUMBER OF SAMPLES TESTED: BREAKTHROUGH TIME: 2 MIN DETECTABLE LIMIT STEADY STATE PERMEATIC SAMPLE THICKNESS: 7: SELECTED DATA POINTS  TIME: 1. : 2. : 3. : 4. : 5. :	FED: One (Run I) 50 minutes 13 ppm ON RATE 57.18 ug/	cm2*hr : CONCENTRATION : :	:	N/A			
4. TE 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Mall:  ST RESULTS  DATE TESTED: 12-23-86 NUMBER OF SAMPLES TEST BREAKTHROUGH TIME: 2 MIN DETECTABLE LIMIT STEADY STATE PERMEATIC SAMPLE THICKNESS: 7 SELECTED DATA POINTS  TIME: 1. : 2. : 3. : 4. : 5. : 6. :	FED: One (Run I) 50 minutes 13 ppm ON RATE 57.18 ug/	cm2*hr : CONCENTRATION : :		N/A			
4. TE 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Mall:  ST RESULTS  DATE TESTED: 12-23-86 NUMBER OF SAMPLES TEST BREAKTHROUGH TIME: 2 MIN DETECTABLE LIMIT STEADY STATE PERMEATIC SAMPLE THICKNESS: 7 SELECTED DATA POINTS  TIME:  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	FED: One (Run I) 50 minutes 13 ppm ON RATE 57.18 ug/	cm2*hr : CONCENTRATION : :		N/A			
4. TE 1. 2. 3. 4. 5.	CHEMICAL SOURCE: Mall:  ST RESULTS  DATE TESTED: 12-23-86 NUMBER OF SAMPLES TEST BREAKTHROUGH TIME: 2 MIN DETECTABLE LIMIT STEADY STATE PERMEATIC SAMPLE THICKNESS: 7: SELECTED DATA POINTS  TIME: 1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :	FED: One (Run I) 50 minutes 13 ppm ON RATE 57.18 ug/	cm2*hr : CONCENTRATION : :		N/A			
4. TE 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOURCE: Mall:  ST RESULTS  DATE TESTED: 12-23-86 NUMBER OF SAMPLES TEST BREAKTHROUGH TIME: 2 MIN DETECTABLE LIMIT STEADY STATE PERMEATIC SAMPLE THICKNESS: 7 SELECTED DATA POINTS  TIME:  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	FED: One (Run I) 50 minutes 13 ppm ON RATE 57.18 ug/	cm2*hr : CONCENTRATION : :		N/A			
4. TE 1. 2. 3. 4. 5. 6. 7.	CHEMICAL SOURCE: Mall:  ST RESULTS  DATE TESTED: 12-23-86 NUMBER OF SAMPLES TES: BREAKTHROUGH TIME: 2 MIN DETECTABLE LIMIT STEADY STATE PERMEATIC SAMPLE THICKNESS: 7 SELECTED DATA POINTS  TIME:  1. :: 2. :: 3. :: 4. :: 5. :: 6. :: 7. :: 8. :: 9. :: 10. ::	FED: One (Run I) 50 minutes 13 ppm ON RATE 57.18 ug/	cm2*hr : CONCENTRATION : :		N/A			

## Nitrobenzene Run



Detector temp:

Input attn: 10

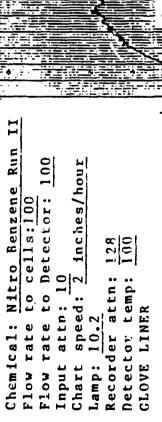
Lamp: 10.2

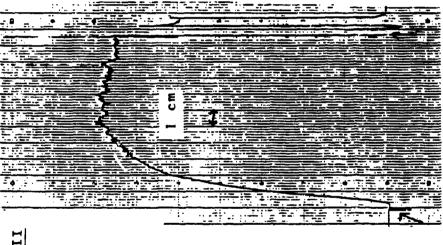
Switched from cells to standard gas Nkrobenzene charged into cells

G-46

_	CONDITION BEFO	TERIAL CODE: 044 ORE TEST: Unuse		le imperfection	ns	
4:		Chemfab Corp.				
5:		FICATION: Inne		t stock		
6: 7:		CTURER DATE: N/A NESS: 7-9 mils	<del></del>			
/: 8:		(E33. /-9 WIIS	<del> </del>			<del></del>
•						
TE	ST METHOD					
		ATORY: Texas Res				
	<del>-</del>	HOD: Continuou	s photeioni:	ation detecti	on wit	h a 10.20 eV 1
	TEMPERATURE:					
	COLLECTION ME					
	COLLECTION SYS	ONS: 1 inch ce	1) was wood	/Detector Tor		1000
		ON ASTM F739 MET				
						<del></del>
Ci.	ALLENG: CHEMICAL	1	: (	COMPONENT 2	:	3
1.	CHEM NAME(s)	: Nitrobenzene	:	N/A	:	n/A
2.	CAS NUMBER(s)	98-95-3		n/a		N/A
	CONC. (IF MIX		<u> </u>	N/A	;	N/A
4.	CHEMICAL SOUR	CE:Mallinckrodt	:	N/A	:	N/A
_		1777				
2 · 3 · 4 · 5 ·	BREAKTHROUGH TO MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES	LES TESTED: On IME: 2.50 minu LIMIT .14 ppm ERMEATION RATE ES: 7 mils	tes	·/hr		
2. 3. 4. 5.	NUMBER OF SAMPI BREAKTHROUGH TO MIN DETECTABLE STEADY STATE PR	LES TESTED: On IME: 2.50 minu LIMIT .14 ppm ERMEATION RATE ES: 7 mils	tes	/hr		
2 · 3 · 4 · 5 ·	NUMBER OF SAMPI BREAKTHROUGH TO MIN DETECTABLE STEADY STATE PE SAMPLE THICKNESS	LES TESTED: On IME: 2.50 minu LIMIT .14 ppm ERMEATION RATE ES: 7 mils	tes 55.97 ug/cm	CONCENTRATIO	ON :	© NCENTRATION
2 · 3 · 4 · 5 ·	NUMBER OF SAMPI BREAKTHROUGH TO MIN DETECTABLE STEADY STATE PH SAMPLE THICKNES SELECTED DATA IN TIME 1.	LES TESTED: On IME: 2.50 minu LIMIT .14 ppm ERMEATION RATE SS: 7 mils POINTS N/A	tes 55.97 ug/cm		) : NC:	CONCENTRATION
2 · 3 · 4 · 5 ·	NUMBER OF SAMPI BREAKTHROUGH TO MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA I  TIME  1. 2. 3.	LES TESTED: On IME: 2.50 minu LIMIT .14 ppm ERMEATION RATE SS: 7 mils POINTS N/A	tes 55.97 ug/cm		)N : :	© NCENTRATION
2 · 3 · 4 · 5 ·	NUMBER OF SAMPI BREAKTHROUGH TO MIN DETECTABLE STEADY STATE PR SAMPLE THICKNES SELECTED DATA IN TIME 1. 2.	LES TESTED: On  IME: 2.50 minu  LIMIT .14 ppm  EXMEATION RATE  SS: 7 mils  POINTS N/A  : CONCENT : :	tes 55.97 ug/cm <sup>2</sup> RATION : :		)N : : :	CONCENTRATION
2 · 3 · 4 · 5 ·	NUMBER OF SAMPI BREAKTHROUGH TO MIN DETECTABLE STEADY STATE PR SAMPLE THICKNES SELECTED DATA I  TIME  1. 2. 3. 4. 5.	LES TESTED: On  IME: 2.50 minu  LIMIT .14 ppm  EXMEATION RATE  SS: 7 mils  POINTS N/A  : CONCENT :	tes 55.97 ug/cm		) N : : : : : : : : : : : : : : : : : :	CONCENTRATION
2 · 3 · 4 · 5 ·	NUMBER OF SAMPI BREAKTHROUGH TO MIN DETECTABLE STEADY STATE PR SAMPLE THICKNES SELECTED DATA I  TIME  1. 2. 3. 4. 5. 6.	LES TESTED: On  IME: 2.50 minu  LIMIT .14 ppm  EXMEATION RATE  SS: 7 mils  POINTS N/A  : CONCENT : :	tes 55.97 ug/cm <sup>2</sup> RATION : :		ON : : : : : : : : : : : : : : : : : : :	© NCENTRATION
2 · 3 · 4 · 5 ·	NUMBER OF SAMPI BREAKTHROUGH TO MIN DETECTABLE STEADY STATE PR SAMPLE THICKNES SELECTED DATA I  TIME  1. 2. 3. 4. 5. 6. 7.	LES TESTED: On  IME: 2.50 minu  LIMIT .14 ppm  EXMEATION RATE  SS: 7 mils  POINTS N/A  : CONCENT : :	tes 55.97 ug/cm <sup>2</sup> RATION : :		)N :	CONCENTRATION
2 · 3 · 4 · 5 ·	NUMBER OF SAMPI BREAKTHROUGH TO MIN DETECTABLE STEADY STATE PR SAMPLE THICKNES SELECTED DATA IN TIME 1. 2. 3. 4. 5. 6. 7.	LES TESTED: On  IME: 2.50 minu  LIMIT .14 ppm  EXMEATION RATE  SS: 7 mils  POINTS N/A  : CONCENT : :	tes 55.97 ug/cm <sup>2</sup> RATION : :		ON : : : : : : : : : : : : : : : : : : :	CONCENTRATION
2 · 3 · 4 · 5 ·	NUMBER OF SAMPI BREAKTHROUGH TO MIN DETECTABLE STEADY STATE PR SAMPLE THICKNES SELECTED DATA I  TIME  1. 2. 3. 4. 5. 6. 7.	LES TESTED: On  IME: 2.50 minu  LIMIT .14 ppm  EXMEATION RATE  SS: 7 mils  POINTS N/A  : CONCENT : :	tes 55.97 ug/cm <sup>2</sup> RATION : :		ON : : : : : : : : : : : : : : : : : : :	© NCENTRATION
2.34.56.7	NUMBER OF SAMPI BREAKTHROUGH TO MIN DETECTABLE STEADY STATE PR SAMPLE THICKNES SELECTED DATA I  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	LES TESTED: On  IME: 2.50 minu  LIMIT .14 ppm  ERMEATION RATE  SS: 7 mils  POINTS N/A  : CONCENT: :: :: :: ::	tes 55.97 ug/cm <sup>2</sup> RATION : :		ON : : : : : : : : : : : : : : : : : : :	© NCENTRATION
2.4.5.67	NUMBER OF SAMPI BREAKTHROUGH TO MIN DETECTABLE STEADY STATE PE SAMPLE THICKNES SELECTED DATA I  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	LES TESTED: On  IME: 2.50 minu  LIMIT .14 ppm  ERMEATION RATE  SS: 7 mils  POINTS N/A  : CONCENT: :: :: :: ::	tes 55.97 ug/cm <sup>2</sup> RATION : :		ON : : : : : : : : : : : : : : : : : : :	CONCENTRATION

## Nitrobenzene Run II

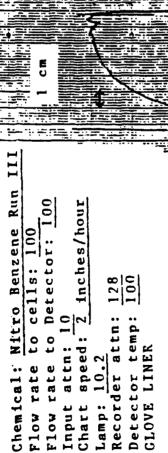


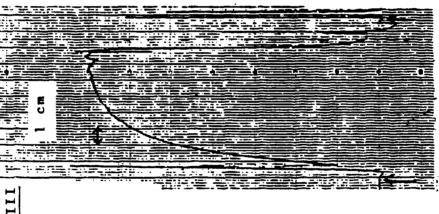


90 80 80 Nkrobenzene charged into cells Switched from cells to standard

DESCRIP	TION OF PROI	DUCT EVALUATED				
1: TYPE	E: Teflon					
		RIAL CODE: 044				
		RE TEST: Unused,	no visible	imperfect	ions	· • · · · · · · · · · · · · · · · · · ·
4: MANI	FACTURER:	Chemfab Corp.		ampera det.	20113	
		ICATION: Inner	love sheet	stock		
		URER DATE: N/A	zove sheet	BLOCK	······	
		SS: 7-9 mils				
	RIPTION:					
			· · · · · · · · · · · · · · · · · · ·			
TEST MET	THOD					
1. TEST	TING LABORAT	ORY: Texas Resear	ch Institu	te. 9063 B	ee Caves R	oad Austin TX
2. ANAI	YTICAL METH	IOD: Continuous p	hotojoniza	tion detect	tion with	a 10.20 eV lemm
	PERATURE: 22				CZOII WZ CII	a rotto ev ramp
	ECTION MEDI		<del></del>		<del></del>	
	ECTION SYST		<del></del>	·		
		S: linch cell	was used.	Detector To		= 100C
7. DEVX	ATIONS FROM	ASTM F739 METHOD	: Flow rate	e was 100	cc/min-	<u> </u>
CHALLENG	E CHEMICAL	1	: CO	MPONENT 2	•	3
			:		:	
1. CHE	NAME(s):	Nitrobenzene	:	N/A	:	N/A
2. CAS	NUMBER(s):	98-95-3	:	N/A	:	N/A
3. CONC	(XF MIX)	N/A		N/A	<del></del> :	N/A
4. CHEM	ICAL SOURCE	Maliinckrodt	:	N/A	::	N/A
TEST RES	SULTS					
1. DATE	TESTED: 12	2-23-86				
		S TESTED: One (R	un III)			
		E: 2.50 minutes		<del> </del>	· · · · · · · · · · · · · · · · · · ·	
4. MIN D	ETECTABLE I	IMIT .14 ppm		· · · · · · · · · · · · · · · · · · ·		· - · · · · · · · · · · · · · · · · · ·
5. STEAD	Y STATE PER	MEATION RATE 57.	79 119/cm2*	hr		
6. SAMPI	E THICKNESS	: 7 mils	,, 08, 0			
	TED DATA PO					
	TIME	: CONCENTRAT	ion :	CONCENTRAT	ION : C	ONCENTRATION
1		<u>:</u>	:	· · · · · · · · · · · · · · · · · · ·		
2		:			:	
3		:	:		:	
4	·		:		:	
5.		:	<u>:</u>		\$	
6		:	•		:	
7.		:	:		:	
8		<u>:</u>	•		:	
9.		•	•		:	
10.			:		:	
8. OTHER	OBSERVATIO	NS:				
SOURCE O	F DATA					
		un by Denise McDo	nald on De	cember 23.	1986	

## Nitrobenzene Run III





Nitrobenzene charged into cells

1:	: TYPE: Teflon			
2:		44		<del></del>
2. 3:			-fections	
3: 4:			Trections	
5:	·			· · · · · · · · · · · · · · · · · · ·
_			<u> </u>	
6:				
	NOMINAL THICKNESS: 7-9 mil	5		
8:	DESCRIPTION:			
. TE	EST METHOD			
1.	. TESTING LABORATORY: Texas R	esearch Institute. 9	063 Bee Caves	Road. Austin. T
2.				
3.		OGO PHOLOSOSIAN		
4.				
5.				<del></del>
5. <b>6.</b>		cell was used. /Detec	the Terreser	<b>≈ 600</b>
7.				
′•	DEVIRTIONS FROM ASIM F739 M	Flow rate wa	is 100 CC/MIN.	
. CE	EQUENCE CHEMICAL 1	: COMPONE	NT 2 :	3
		:	•	
1.		ethane : N/A	·	N/A
	CAS NUMBER(s): 79-34-5	: N/A	:	N/A
3.	CONC. (IF MIX) N/A	: N/A	:	N/A
		• • • • • • • • • • • • • • • • • • • •		
. TE	EST RESULTS	: N/A		N/A
4. TE	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils	ne (Run I) utes		
4. TE	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		N/A
4. TE 1. 2. 3. 4. 5. 6.	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCE	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		
4. TE 1. 2. 3. 4. 5.	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCE  1.	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		N/A
4. TE 1. 2. 3. 4. 5.	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCE  1	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		N/A
4. TE	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCE  1. : 2. : 3. :	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		N/A
4. TE 1. 2. 3. 4. 5. 6.	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCE  1	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		N/A
4. TE 1. 2. 3. 4. 5. 6.	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCE  1. : 2. : 3. : 4. : 5. :	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		N/A
4. TE	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCE  1. : 2. : 3. : 4. : 5. : 6. :	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		N/A
4. TE 1. 2. 3. 4. 5. 6.	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCE  1. : 2. : 3. : 4. : 5. : 6. : 7. :	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		N/A
4. TE	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCE  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		N/A
4. TE	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCE  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		N/A
4. TE	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCE  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. :	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		N/A
4. TE	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCE  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		N/A
4. TE	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCE  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. :	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		N/A
4. TE	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCE  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		N/A
4. TE	DATE TESTED: 1-29-87  NUMBER OF SAMPLES TESTED: 0  BREAKTHROUGH TIME: 2.5 min  MIN DETECTABLE LIMIT 2.81 p  STEADY STATE PERMEATION RATE  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCE  1. : 2. : 3. : 4. : 5. : 6. : 7. : 8. : 9. : 10. :	: N/A ne (Run I) utes pm 1189 (ug/cm <sup>2</sup> *hr)		N/A

## Tetrachloroethane Run I

Chemical: Tetrachloroethane Run I
Flow rate to celis: 100
Flow rate to Detector: 100
Input attn: 1
Chart speed: 2 in/hr
Lamp: 11.7
Recorder attn: 256
Detector temp: 60
CLOVE LINER, INDIVIDUAL

Tetrachloroethans charged into cells

2 3	: PROTECTIVE MATERIAL CO		isible	imperfection	ons	
4			•,			
5	: PRODUCT IDENTIFICATION	N: Inner glove	sheet	stock		
6						
7		-9 mils		<del> </del>		
8	: DESCRIPTION:					
T	EST METHOD					
1.						
2.	. ANALYTICAL METHOD: Co . TEMPERATURE: 22-25°C	ntinuous photo	10012	tion detect:	ion with	# 11./U eV 1am
ے. 4.		<del></del>		<del></del> -		<del></del>
	. COLLECTION SYSTEM: N					
	OTHER CONDITIONS: 1		used.	Detector Tes	neratur	e = 60C_
	DEVIATIONS FROM ASTM					
O	RALLENGE CHEMICAL	1	= C(	MPONENT 2	:	3
1	. CHEM NAME(s): Tetra	.h1+h	•	N/A	•	N/A
	. CAS NUMBER(s): 79-34		·:	N/A	:	N/A
	CONC. (IF MIX) N/A	<u></u>	:	N/A	;	N/A
4		-h :	·:	N/A	<u>:</u>	N/A
2 3 4 5 6	. DATE TESTED: 1-30-37 . NUMBER OF SAMPLES TEST: . BREAKTHROUGH TIME: 2 . MIN DETECTABLE LIMIT: . STEADY STATE PERMEATION . SAMPLE THICKNESS: 7 mm	5 minutes 2.78 ppm N RATE 1132 (		*hr)		
7.	. SELECTED DATA POINTS	N/A				
	•	CONCENTRATION	:	CONCENTRATIO	ON :	CONCENTRATION
	2.	<del></del>	<del></del> -		<del></del> -	
	3.		:		:	
	4:	<del></del>	:	<del></del>	:	
	5:		:		;	
	6. :		:			
	_	-	:		:	
	7. :		:		<u>:</u>	
	8:				•	
	8. : 9. :		:		<del></del>	
	8:		:			
8.	8. : 9. : 10. :		:			

Chemical Resistance Testing of Glove Liner

Tetrachloroethane Run II

Chemical: Tetrachloroethane Run II Flow rate to cells: 100

100

Flow rate to Detector:

Input atim:

Recorder attn: 256
Detector temp: 60
GLOVE LINER, INDIVIDUAL

Chart speed: 2 in/hr Lamp: 11.7

## Tetrachloroethane charged into cells

1:	PROTECTIVE MAT	ERIAL CODE: 044							
3:									
4:	MANUFACTURER: Chemfab Corp. PRODUCT IDENTIFICATION: Inner glove sheet stock								
5: 6:		TURER DATE: N/A	ve sneet stock						
7:		ESS: 7-9 mils							
8:									
					<del></del>				
TE:	ST METHOD								
1.		TORY: Texas Research							
2.			toionization detect	ion with	a 11.70 eV lan				
3. 4.									
5.									
	DIHER CONDITIO		s used./Detector Te	merature	= 50C_				
7.		M ASTM F739 METHOD:							
CIL.	CIENTE CHEMICAL	1	: COMPONENT 2	<b>:</b>	3				
1.	CHEM NAME(s):	Tetrachloroethane	: N/A	:	N/A				
	CAS NUMBER(s):		: N/A		N/A				
3.	CONC. (IF MIX)		: N/A	:	N/A				
4.	CHEMICAL SOURCE	E:Aldrich	: N/A	:	N/A				
1. 2. 3. 4.	NUMBER OF SAMPI BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE	RMEATION RATE 1049							
6.	D.E	S: 7 mils							
7.	SELECTED DATA P	OINTS N/A							
	TIME	: CONCENTRATIO	ON : CONCENȚRATI	on : c	ONCENTRATION				
	1.	:		<u> </u>					
	2	:	<del>:</del>	<u>.</u>	<del> </del>				
	4.	· · · · · · · · · · · · · · · · · · ·	<u>:</u>	<u> </u>					
		<del>-:</del>	•	<del></del>					
	J.	•		•					
	5		:	:	<del></del>				
		:	•						
	6. 7. 8.	:		:					
	6. 7. 8. 9.			<u>:</u>					
	6. 7. 8.	:		:					
9	6. 7. 8. 9.			:					
8.	6. 7. 8. 9.								

## Tetrachloroethane Run III

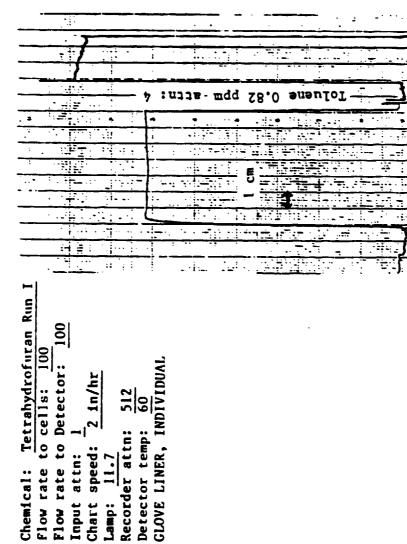
Chemical: Tetrachloroethane Run III
Flow rate to cells: 100
Flow rate to Detector: 100
Input attn: 1
Chart speed: 2 in/hr
Lamp: 11.7
Recorder attn: 256
Detector temp: 60
GLOVE LINER, INDIVIDUAL

Toluene 0.82 ppm attn: 4

Tetrachioroethane charged into cells

3:	PROTECTIVE MATERIAL CONDITION BEFORE TE		visible	imperfection	ns	
:	MANUFACTURER: Chem	fab Corp.				
5:	PRODUCT IDENTIFICAT	ION: Inner glov	e sheet	stock		
<b>;</b>	LOT OR MANUFACTURES	DATE: N/A				
<b>':</b>	NOMINAL THICKNESS:	7-9 mils				
3:	DESCRIPTION:					
ŒS	ST WETHOD					
	TESTING LABORATORY:	Texas Research	Institut	e, 9063 Bee	Caves	Road, Austin,
•	ANALYTICAL METHOD:		oionizat:	ion detecti	on with	a 11.70 eV la
	TEMPERATURE: 22-25° COLLECTION MEDIUM:					
	COLLECTION SYSTEM:					·····
	OTHER CONDITIONS:		aread. /De	etector Tem	Deretur	= 60C
	DEVIATIONS FROM AST	M F739 METHOD:	Flow rate	e was 100 c	c/min.	
HA	LIENCE CHEMICAL	1	: COM	Ponent 2	2	3
	CHEM NAME(s): Tet	rahvdrafaran	:	N/A	•	N/A
	CAS NUMBER(s): 109		_:	N/A	<u>`</u>	N/A
	CONC. (IF MIX) N/A		: <del></del>	N/A		N/A
	CHEMICAL SOURCE: A1			N/A	— <u>;</u> —	N/A
	DATE TESTED: 1-30- NUMBER OF SAMPLES TE BREAKTHROUGH TIME: MIN LETECTABLE LIMIT STEADY STATE PERMEAT SAMPLE THICKNESS: 7	STED: One (Run 2.5 minutes 8.04 ppm TON RATE 1655 mils		hr)		
•	SELECTED DATA POINTS	N/A				
		CONCENTRATION	: C	ONCENTRATIO	N:	CONCENTRATION
•	TIME :	CONCENTION			•	
•	1. :		:	<del></del>	<del>:</del> -	
•	1. : 2. :		<u>:</u>		<u>;</u>	
•	1. : 2. : 3. :		:			
•	1. : 2. : 3. : 4. :					
•	1. : : : : : : : : : : : : : : : : : : :					
•	1. : : : : : : : : : : : : : : : : : : :				:	
•	1. : : : : : : : : : : : : : : : : : : :					
	1. : : : : : : : : : : : : : : : : : : :					
	1. : : : : : : : : : : : : : : : : : : :					
	1. : : : : : : : : : : : : : : : : : : :					

## Tetrahydrofuran Run I

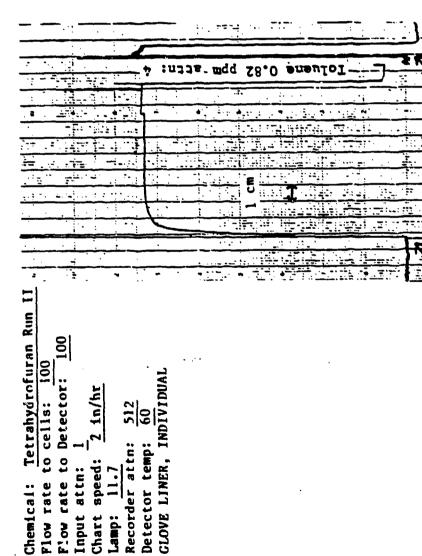


Tetrahydrofuran charged into cells

1:	TYPE: Teflon				
2:	PROTECTIVE MA	TERIAL CODE: 044			
3:	CONDITION BEF	ORE TEST: Unused,	no visible impe	rfections	
4:	MANUFACTURER:	Chemfab Corp.			
5:	PRODUCT IDENT	IFICATION: Inner	glove sheet stoc	k	
		CTURER DATE: N/A			······································
7:		NESS: 7-9 mils			
8:	DESCRIPTION:				
TES	T METHOD				
1.	TESTING LABOR	ATORY: Texas Resea	rch Institute. 9	063 Bee Caves	Road, Austin, T
	ANALYTICAL ME	THOD: Continuous	photoionization	detection with	a 11.70 eV 1am
	TEMPERATURE:		<u></u>		
	COLLECTION ME	<del></del>			
	COLLECTION SY			<del></del>	
		ONS: linch cell	was used /Datas	tor Temperatur	2 500
7	DENIATIONS ED	OM ASIM F739 METHO	Was used: /Detec	100 co/min	e - 00c.
4.	TENTALIUNS PR	nu worm 1/32 werun	D: I TOW TAKE WE	s 100 gc/min.	
CRA	LIENGE CHEMICA	L 1	: COMPONE	NT 2 :	3
1.	CHEM NAME(s)	: Tetrahydrofuran	N/A	:	N/A
2.	CAS NUMBER(s)	: 109-99-9	N/A		N/A
	CONC. (IF MIX		N/A		N/A
	CHEMICAL SOUR		N/A		N/A
2. 3. 4. 5. 6.	BREAKTHROUGH T MIN DETECTABLE	LES TESTED: One ( IME: 2.5 minutes LIMIT 9.57 ppm ERMEATION RATE 1 SS: 7 mils			
	TIME	: CONCENTRA	TION : CONCE	NTRATION :	CONCENTRATION
	·	:	<u> </u>	•	
	3.	<del></del>	<u>.</u>	<del></del>	
	4.	<del>- :</del>		<del></del>	
	5.	<del></del>	<u>-</u>	<del></del> ;	
	6	<u>:</u>	<del></del>	<del></del>	
	7.	_ <del>:</del>		<del></del>	
	%. ————	<del></del>	<del></del>	<del></del>	
	9. ————	<del></del>	<del></del>		<del></del>
			<del></del>		
	10		<u> </u>	<u> </u>	
•					
	OTHER OBSERVAT	IONS:			

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## Tetrahydrofuran Run II



Switched from cells to standard gas

Tet-shydrofuran charged into cells

G-60

1:		E: Teflon								
2:		TECTIVE MA								
3:		CONDITION BEFORE TEST: Unused, no visible imperfections								
4:	MAN	MANUFACTURER: Chemfab Corp.								
5:	PRO	PRODUCT IDENTIFICATION: Inner glove sheet stock LOT OR MANUFACTURER DATE: N/A								
6: 7:		I OK MANUF?								
8:		CRIPTION:		7-9 mile						
TE	ST ME	THOD	<del></del>							
1.							es Road, Austin, I			
2.		LYTICAL ME			oioniz	ation detection w	ith a 11.70 eV lan			
		PERATURE:								
		LECTION M	_							
		LECTION ST				/Danasa - Tanasa	- 40C			
						/Detector Tempera ate was 100 cc/mi				
CH	alien	GE CHEMICA	IL	1	: 0	OMPONENT 2 :	3			
1.	CHE	M NAME(s)	: Tet:	rahydrofuran	: :	N/A :	N/A			
2.		NUMBER(s)	): 109	-99-9	-:	N/A :	N/A			
3.		C. (IF MI)	$()$ $\frac{N/A}{}$	· · · · · · · · · · · · · · · · · · ·	_;	N/A :	N/A			
4.	CHE	MICAL SOUR	CE: Ald	rich	-:	N/A	N/A			
TE	ST RE	SULTS								
		_	2-02-							
				STED: One (Run	III)					
		KTHROUGH 1		2.5 minutes						
4.	MIN	DETECTABLE	LIMIT	8.99 ppm	, , , ,	<del>)</del>				
				ION RATE 1882	(ug/cz	rant)	<del> </del>			
		PLE THICKNE CTED DATA					<del> </del>			
	٠	TIME	:	CONCENTRATION	:	CONCENTRATION :	CONCENTRATION			
	1	<del></del>	<u>:</u>	·	:					
	2		<del>:</del>		:_					
	3	· · · · · · · · · · · · · · · · · · ·	:	·	<u>:</u>		· · · · · · · · · · · · · · · · · · ·			
	<b>5.</b> -		<del></del> -		<del>:-</del>	<u></u>				
	6		<del></del>		<del>:-</del>		· ·			
	7		<del>:</del>		<del></del>		·			
	8	<del></del>	<del></del> -		<del></del>		<u> </u>			
	9.	·	:	<del></del>	:					
	10.		:		:					
	<b>A</b> TUT	R OBSERVAT	TTONE.							

G-6

# Chemical Resistance Testing of Glove Liner

### Tetrahydrofuran Run 🚻

Chemical: Tetrahydrofuran Run III Flow rate to cells: 100 Flow rate to Detector: 100 Recorder attn: 512 Detector temp: 60 GLOVE LINER, INDIVIDUAL Input attn: 1 Chart speed: 2 Lamp: 11.7 Recorder attn:

Tetrahydrofuran charged ito cells

Switched from ceils to standard gas

. DES	CRIPTION OF PRO	DUCT EVALUATED		
1.	TYPE: Teflon			
	PROTECTIVE MAT	ERIAL CODE: 044		
		RE TEST: Unused, no vi	sible imperfections	
	MANUFACTURER:			
		FICATION: Inner glove s	heet stock	
	LOT OR MANUFAC			<del></del>
	NOMINAL THICKN			
	DESCRIPTION:	200. 7 2 4113		
0.				
. Tes	ST METHOD			
1.	TESTING LABORA	TORY: Texas Research In	stitute, 7063 Bee Cav	es Road, Austin, TX
2.	ANALYTICAL MET	HOD: Continuous photoi	onization detection w	ith a 10.20 eV lamp
3.	TEMPERATURE: 2	2-25°C		
	COLLECTION MED			
5.	COLLECTION SYS	TEM: N2		
		NS: 1 inch cell was w	sed. / Detector Tempera	ature = 100C.
		M ASTM F739 METHOD: F1		
. The	LLENGE CHEMICAL	1 :	COMPONENT 2 :	3
1.	CHEM KAME (s) :	Toluene	N/A :	N/A
2.	CAS NUMBER(s):	108-88-3:	N/A :	N/A
3.	CONC. (IF MIX)	N/A	N/A:	N/A
4.	CHEMICAL SOURCE	E:Mallinckrodt :	N/A :	N/A
3. 4. 5.	BREAKTHROUGH TI MIN DETECTABLE STEADY STATE PE	RMEATION RATE Not meas		
	SAMPLE THICKNES	the state of the s		
/ •	SFLECTED DATA P	OINTS N/A		
	TIME	: CONCENTRATION	: CONCENTRATION :	CONCENTRATION
-	2.	•		
	3.	•	•	
	4.	•	<u></u>	
	5.	•	•	
		<del></del>	· · · · · · · · · · · · · · · · · · ·	
	6.	<u> </u>		<del></del>
	7.	<u>- • • • • • • • • • • • • • • • • • • •</u>	<u> </u>	<del></del>
	8.			
	9.		<u> </u>	
	10	:		
8.		ONS: Toluene broke thro	ough at a rate exceedi	ng the limits of the
	detection sy ug/cm²/hr.	stems. The steady state	te permeation rate was	greater than 500
. so	URCE OF DATA		d D 20 1004	
	Sample was	run by Denise McDonal	a on December 30, 1980	) •

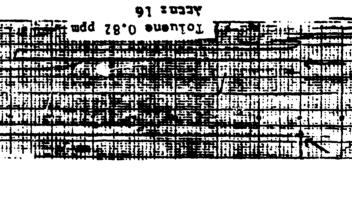
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## Chemical Resistance Testing of Gove Liner

STATE OF THE PARTY

### Toluene Run I

Flow rate to cells: 100cc/min Flow rate to Detector: 100cc/min Input attn: 10 Chart speed: 2 inchcs/hour Lamp: 10.20 Recorder attn: 1024



Towene charged into cells Switched from tells to standard gas

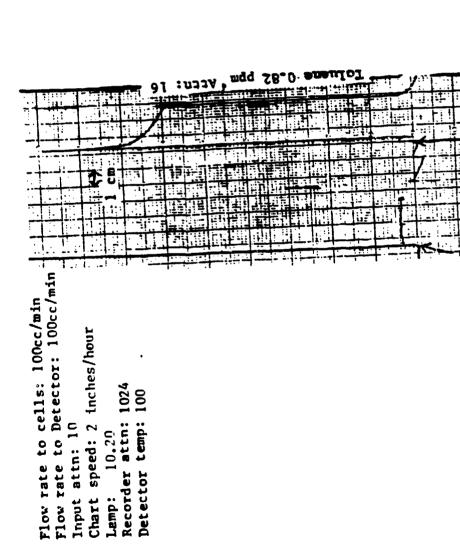
G-6

1: TYPE: Teflon 2: PROTECTIVE HATERIAL CODE: 044 3: CONDITION BEFORE TEST: Unused, no visible imperfections 4: MANUFACTURER: Chemfab Corp. 5: PRODUCT IDENTIFICATION: Inner glove sheet stock 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 6: DESCRIPTION:  2. TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 3063 Bee Caves Road, Austi 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION SYSTEM: N <sub>2</sub> 6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperature = 100C.	
2: PROTECTIVE HATERIAL CODE: 044  3: CONDITION BEFORE TEST: Unused, no visible imperfections  4: MANUTACTURER: Chemfab Corp.  5: PRODUCT IDENTIFICATION: Inner glove sheet stock  6: LOT OR MANUFACTURER DATE: N/A  7: NOMINAL THICKNESS: 7-9 mils  6: DESCRIPTION:  2. TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 3063 Bee Caves Road, Austi  2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV  3. TEMPERATURE: 22-25 C  4. COLLECTION MEDIUM: N2  5. COLLECTION SYSTEM: N2  6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperature = 100C.	
3: CONDITION BEFORE TEST: Unused, no visible imperfections  4: MANUFACTURER: Chemfab Corp.  5: PRODUCT IDENTIFICATION: Inner glove sheet stock  6: LOT OR MANUFACTURER DATE: N/A  7: NOMINAL THICKNESS: 7-9 mils  8: DESCRIPTION:  2. TEST METHOD  1. TESTING LABORATORY: Texas Research Institute, 3063 Bee Caves Road, Austi  2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV  3. TEMPERATURE: 22-25°C  4. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION SYSTEM: N <sub>2</sub> 6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperature = 100C.	
4: MANUFACTURER: Chemfab Corp.  5: PRODUCT 1DENTIFICATION: Inner glove sheet stock  6: 10T OR MANUFACTURER DATE: N/A  7: NOMINAL THICKNESS: 7-9 mils  8: DESCRIPTION:  1. TESTING LABORATORY: Texas Research Institute, 3063 Bee Caves Road, Austi  2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV  3. TEMPERATURE: 22-25°C  4. COLLECTION MEDIUM: N2  5. COLLECTION SYSTEM: N2  6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperature = 100C.	
5: PRODUCT IDENTIFICATION: Inner glove sheet stock 6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 6: DESCRIPTION:  1. TESTING LABORATORY: Texas Research Institute, 3063 Bee Caves Road, Austi 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperature = 100C.	
6: LOT OR MANUFACTURER DATE: N/A 7: NOMINAL THICKNESS: 7-9 mils 6: DESCRIPTION:  1. TESTING LABORATORY: Texas Research Institute, 3063 Bee Caves Road, Austi 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperature = 100C.	
7: NOMINAL THICKNESS: 7-9 mils 6: DESCRIPTION:  1. TESTING LABORATORY: Texas Research Institute, 3063 Bee Caves Road, Austi 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: No. 5. COLLECTION SYSTEM: No. 6. OTHER CONDITIONS: 1 inch cell was used. / Detector Temperature = 100C.	
8: DESCRIPTION:  1. TESTING LABORATORY: Texas Research Institute, 3063 Bee Caves Road, Austi 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV 3. TEMPERATURE: 22-25 °C 4. COLLECTION MEDIUM: No. 5. COLLECTION SYSTEM: No. 6. OTHER CONDITIONS: 1 inch cell was used. / Detector Temperature = 100C.	
1. TESTING LABORATORY: Texas Research Institute, 3063 Bee Caves Road, Austi 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: No.2 5. COLLECTION SYSTEM: No.2 6. OTHER CONDITIONS: 1 inch cell was used. / Detector Temperature = 100C.	
1. TESTING LABORATORY: Texas Research Institute, 3063 Bee Caves Road, Austi 2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N2 5. COLLECTION SYSTEM: N2 6. OTHER CONDITIONS: 1 inch cell was used. / Detector Temperature = 100C.	
2. ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV 3. TEMPERATURE: 22-25°C 4. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION SYSTEM: N <sub>2</sub> 6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperature = 100C.	
3. TEMPERATURE: 22-25°C  4. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION SYSTEM: N <sub>2</sub> 6. OTHER CONDITIONS: 1 inch cell was used./ Detector Temperature = 100C.	/ lat
4. COLLECTION MEDIUM: N <sub>2</sub> 5. COLLECTION SYSTEM: N <sub>2</sub> 6. OTHER CONDITIONS: 1 inch cell was used. / Detector Temperature = 100C.	
5. COLLECTION SYSTEM: N <sub>2</sub> 6. OTHER CONDITIONS: 1 inch cell was used. / Detector Temperature = 100C.	
6. OTHER CONDITIONS: 1 inch cell was used. / Detector Temperature = 100C.	
7. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min.	
. CHALLENGE CHEMICAL 1 : COMPONENT 2 : 3	
1. DIEM NAME(s): Toldene : N/A : N/A	
2. CAS NUMBER(s): 108-88-3 : N/A : N/A	
3. CONC. (IF MIX) N/A : N/A : N/A	
4. CHEMICAL SOURCE: Mallinckrodt : N/A : N/A	
1. DATE TESTED: 1-15-87 2. NUMBER OF SAMPLES TESTED: One (Run II) 3. BREAKTHROUGH TIME: 2.50 minutes	
4. MIN DETECTABLE LIMIT .44 ppm 5. STEADY STATE PERMEATION RATE Not measureable	
5. STEADY STATE PERMEATION RATE Not measureable	
4. MIN DETECTABLE LIMIT .44 ppm 5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A	
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils	
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION	ION
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION: : : : : : : : : : : : : : : : : : :	ION
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION: : : : : : : : : : : : : : : : : : :	ION
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION::::::::::::::::::::::::::::::::::::	ION
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION: 2. : : : : : : : : : : : : : : : : : : :	ION
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION: 1. : : : : : : : : : : : : : : : : : : :	ION
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION: 1. : : : : : : : : : : : : : : : : : : :	ION
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION: 1. : : : : : : : : : : : : : : : : : : :	ION
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION: 1. : : : : : : : : : : : : : : : : : : :	ION
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATI 1. : : : : : : : : : : : : : : : : : : :	ION
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATI  1.	ION
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1.	
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION: 2. : : : : : : : : : : : : : : : : : : :	of
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION:  1. : : : : : : : : : : : : : : : : : : :	of
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION: 2. : : : : : : : : : : : : : : : : : : :	of
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION: 1.	of
5. STEADY STATE PERMEATION RATE Not measureable 6. SAMPLE THICKNESS: 7 mils 7. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION: 1. : : : : : : : : : : : : : : : : : : :	of

## Chemical Resistance Testing of Glove Liner

10.000

### Toluene Run II

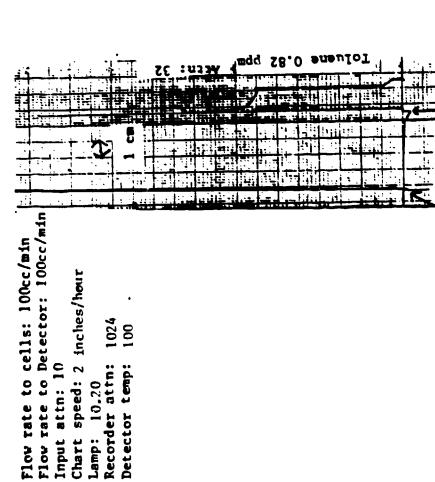


Towene charged into cells cuttched from cells to standard gas

	ESCRIPTION OF PRODUCT EVALUATED						
	: TYPL: Teflon						
	: PROTECTIVE MATERIAL CODE: 044						
	3: CONDITION BEFORE TEST: Unused, no visible imperfections						
	4: MANUFACTURER: Chemfab Corp.						
	5: PRODUCT IDENTIFICATION: Inner glove sheet stock						
	6: LOT OR MANUFACTURER DATE: N/A						
	: NOW NAL THICKNESS: 7-9 mile						
	3: DESCRIPTION:						
2.	TEST METHOD						
	TESTING LABORATORY: Texas Research Institute, 9063 Bee Caves Road, Austin, T						
	ANALYTICAL METHOD: Continuous photoionization detection with a 10.20 eV lamp						
	TEMPERATURE: 22-25°C						
	COLLECTION MEDIUM: N2						
	COLLECTION SYSTEM: N2						
	OTHER CONDITIONS: 1 inch cell was used. / Detector Temperature = 100C. DEVIATIONS FROM ASTM F739 METHOD: Flow rate was 100 cc/min.						
١.	PARLIENCE CHEMICAL 1 : COMPONENT 2 : 3						
•	: :						
	. CHEM NAME(s): Toluene : N/A : N/A						
	. CAS KUMBER(s): 108-88-3 : N/A : N/A						
	CONC. (IF MIX) N/A : N/A : N/A						
	. CHEMICAL SOURCE: Nellinckrodt : N/A : N/A						
	DATE TESTED: 1-15-87  NUMBER OF SAMPLES TESTED: One (Run III) BREAKTHROUGH TIME: 2.50 minutes MIN DETECTABLE LIMIT .47 ppm						
	STEADY STATE PERMEATION RATE Not measureable SAMPLE THICKNESS: 7 mils						
	S. STEADY STATE PERMEATION RATE Not measureable  S. SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A						
	STEADY STATE PERMEATION RATE Not measureable SAMPLE THICKNESS: 7 mils						
	S. STEADY STATE PERMEATION RATE Not measureable  S. SAMPLE THICKNESS: 7 mils  V. SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION						
	STEADY STATE PERMEATION RATE Not measureable  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION 1. : : :						
	STEADY STATE PERMEATION RATE Not measureable  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION  1. : : : : : : : : : : : : : : : : : : :						
	S. STEADY STATE PERMEATION RATE Not measureable  S. SAMPLE THICKNESS: 7 mils  V. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION  1. : : : : : : : : : : : : : : : : : : :						
	S. STEADY STATE PERMEATION RATE Not measureable  S. SAMPLE THICKNESS: 7 mils  V. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:  1. : : : : : : : : : : : : : : : : : : :						
	S. STEADY STATE PERMEATION RATE Not measureable  S. SAMPLE THICKNESS: 7 mils  V. SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:  1. : : : :  2. : : : : :  3. : : : : : :  4. : : : : : : : : : : : : : : : : : : :						
	STEADY STATE PERMEATION RATE Not measureable  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:  1. : : : : : : : : : : : : : : : : : : :						
	STEADY STATE PERMEATION RATE Not measureable  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:  2. : : : : : : : : : : : : : : : : : : :						
	STEADY STATE PERMEATION RATE Not measureable  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:  2. : : : : : : : : : : : : : : : : : : :						
	STEADY STATE PERMEATION RATE Not measureable  SAMPLE THICKNESS: 7 mils  SELECTED DATA POINTS N/A  TIME: CONCENTRATION: CONCENTRATION:  1. : : : : : : : : : : : : : : : : : : :						
	STEADY STATE PERMEATION RATE   Not measureable						
	STEADY STATE PERMEATION RATE   Not measureable						
	S. STEADY STATE PERMEATION RATE Not measureable  S. SAMPLE THICKNESS: 7 mils  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION  1. : : : : : : : : : : : : : : : : : : :						
	STEADY STATE PERMEATION RATE   Not measureable						
	S. STEADY STATE PERMEATION RATE Not measureable  S. SAMPLE THICKNESS: 7 mils  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION  1. : : : : : : : : : : : : : : : : : : :						
5.	STEADY STATE PERMEATION RATE Not measureable  SAMPLE THICKNESS: 7 mils  TIME : CONCENTRATION : CONCENTRATION : CONCENTRATION  1. : : : : : : : : : : : : : : : : : : :						
i	S. STEADY STATE PERMEATION RATE Not measureable  S. SAMPLE THICKNESS: 7 mils  TIME: CONCENTRATION: CONCENTRATION: CONCENTRATION  1. : : : : : : : : : : : : : : : : : : :						

## Chemical Resistance Testing of Glove Liner

### Toluene Run III



G-6

Switched from cells to standard gas

Toluena charged into cells

### APPENDIX H

### PENETRATION TEST DATA FOR SEAM AND CLOSURE SAMPLES

(Contract Report by Anderson Associates)

### Penetration and Degradation Tests of Selected Samples

Final Report August 1986

**Anderson Associates** 

### Penetration and Degradation Tests of Selected Samples

### 1. Objectives

This was a two-part study. One part was to conduct tests for the resistance of Challenge 5100 seams, neoprene zippers, and Teflon glove material to penetration by five chemicals; the second part was to evaluate butyl subber gloves for resistance to degradation by fitteen chemicals.

### P. Approach

The approach used in the penetration test was the ASTM Standard Test Method for Resistance of Protective Clothina Materials to Penetration by Liquids (Designation: F903-84)(Appendix i); and that for degradation was Test Method for Evaluating Protective Clothina Materials For Resistance to Degradation by Liquid Chemicals (Designation: NIOSH 200-84-2702 Deg(Revision 4))(Appendix ii). Penetration is defined in the method as the flow of a chemical through closures, porous materials, seams and pinholes, or other imperfections in a protective clothing material on a nonmolecular level. Degradation is defined as a deleterious change in one or more physical properties of a protective clothing material due to contact with a chemical.

### IL Penetration Tests

Four materials were tested:

- 1. Challenge 5100/ Challenge 5100 Seam
- 2. Challenge 5100/ 10 mil FEP Seam
- 3. 6" Talon zipper on neoprene
- 4. Tellon invergiove (4 mil)

Each material was studied for penetration by five chemicals: water, hexane, toluene, methyl ethyl ketone, and hydrochloric acid. The method was essentially that described in the Standard except that expandable Teflon tape was used in place of the rubber cell-gasket for samples like seams that varied in thickness. It was also necessary to tighten the nuts that hold the cell together to about 15 lbs with a torque wrench. To minimize the amount of liquid leaking, the cell was filled only to cover the test material when it was in the horizontial position and the air pressure was reduced to 1 psig (in accordance with latest draft version of the method).

Final printing and photographs used in this report were prepared by the U.S. Coast Guard Research and Development Center, Avery Point, Groton, CT 06340-6096

AND THE PROPERTY OF THE PROPER

Figure 1(a) shows the standard penetration cell. It was necessary to use a different cell for testing the zippers (Figures 1(b) and 1(c)). The cell was designed by MSTC Walke and constructed at the U.S. Coast Guard Research and **Development Center's** machine shop. The upper chamber was designed to accomodate the heavy zipper and permit liquid to cover it under pressure (Figure 2). This cell required a great deal of care to seal properly and needs modifications.

Each zipper was tested for leaks with water before any other chemical was tested.

All samples were measures using the same micrometer and thickness was recorded as an averaged value of five readings.

None of the tests required using a dye for visibility.

### IV. Degradation Tests

Butyl rubber gloves from North Hand Protection, a division of Siebe North, Inc., were evaluated for resistance to degradation by:

Acetone
Acetonitrile
Carbon Disulfide
Dichloromethane
Dimethyl formamide
Ethyl Acetate
n-Hexane
Methanol
Nitrobenzene
50% Sodium Hydroxide
Concentrated Sulturic Acid
Tetrachloroethylene
Tetrahydroxide

The method was that described in the Standard Method with no modifications. (The method was awkwardly written and required study to insure it was interpreted as its author intended.) The standard degradation test apparatus is shown in Figure 3. Figure 4 shows the setup used to measure elongation.

### V. Recommendations

Zipper Test Cell

The zipper test cell should be revamped. First, the gap between the plexiglass and the frame of the cell is a potential hazard; the plexiclass should be fastened to the frame with more than four screws. Second, the opening in the plate for the zipper seems to be too large; the neoprene does not get good support. This may be one source of leakage. Third, the cell material should be changed. Not only did the acid attack the cell but also components of the cell had rusted from the water. Finally the cell is too heavy and cumbersome to handle safely. A lighter weight material in a more comp design should be used. A new support that would fit more easily in the hood would allow more work to be done in the hood adjacent to the test.

### **Eiongation Test**

The elongation test procedure should indicate how much material should be in the clamp. The elongation measurement also seem to depend on the contour of the material. Since the butyl rubber samples were cut from gloves the samples varied in contour, e.g. around the thumb hole.

Test samples were very difficult to cut after exposure to a destructive

chemical, i.e. one that swells the sample and makes it gummy. Results cannot be precise because of inaccurately cut samples.

Room air currents (from the hood, air conditioner, dehumidifier) also affected measurements.

### Weight measurements

The blotting paper drying technique did not always give "dry" samples. A few samples had to be air dried before they where mean cred.

The Ziploc® bag used as a weighing bottle is a very handy device, but care must be taken that the test chemical store not west with the bag. And it was not always possible to remove all the gases by "burping" the bag and weight was naturally affected.

The description of the calculations for the weight change seemed needlessly complex.

### Cleaning the cells

Better methods for cleaning the test cells should be outlined.

### Safety

The degradation cell should come with a fitted cover. This would prevent loss of test chemical and also prevent accidential spilling when the test setup is in the hood.

### VI. Penetration Conclusions

No penetration was observed durin; any of these tests, either during the first 5-minute test at 1 atmosphere pressure or the subsequent 10 minutes at 1 or 2 psig. Thickness measurements varied widely on single seam samples.

### VII. Degradation Conclusions

The results of the degradation tests are summarized in Table I. While no chemical totally destroyed the glove material, several chemicals have enough of an effect on the rubber to pose a hazard for using these gloves for protection. These chemical are listed in Table II.

Table 1.

Results of the Degradation Tests on Butyl Rubber

Chemical	Thickness (percent change)	Elongation (percent change)	Weight (percent change)	Visible Changes
Acetone	3.40	0.76	3.20	Discolored
Acetonotrile	0.95	2.10	1.80	
Carbon Disulfida	24.00	28.70	19.20	Softened/bubbled
Dichloromethane	9.80	46.50	7.75	Softened/distorted
Diethylamine	17.20	65.70	4.50	
Dimethylformamide	0.05	4.10	8.00	
Ethyl Acetate	0.31	0.84	1.32	
N-Hexane	11.40	57.96	3.80	Cracked
Methanol	0.66	3.30	1.70	
Nitrobenzene	1.60	3.20	1.40	
50% Sodium Hydroxide	0.95	0.86	4.50	
Sulfuric Acid	0.98	0	0.87	
Tetrachloroethylene	80.50	Tore	86.60	Sticky/softened
Tetrahydrofuran	9.20	93.40	10.40	•
Toluene	46.00	90.00	33.00	Softened/discolored

### Table II. Hazardous to use with Butyl Rubber

Carbon Disulfide
Dichloromethane
Diethylamine
N-Hexane

Tetrachloroethylene
Tetrahydrofuran
Toluene

Penetration	Yat on Test Cond	ole III. ditions for	r 6 inch Zi	ppers
Toluene	ъ			
	Initial	RH	Temp	Date
4	Thickness		<b>℃</b>	('86)
1.	12	78%	.22	6/5
2.	11.4	78%	22	6/5
3.	12.8	78%	22	<b>6/5</b>
Hexane	· /:			: e
1.	12.2	77%	32	6.3
2.	13.4	77%	22	6/2
<b>.3.</b>	12.7	77%	22	5/2
HCI.				
1.	15.2	75%	25	7/2
2.	12.4	75%	25	7/2
3.	10.3	75%	25	7/2
Methyl	Ethyl Keto	one		ı der .
1.	4.2	77%	24	6/5
2.	4.3	77 <del>%</del>	24	6/5
3.	4.2	77%	24	6/5
·· Water ·	.4			
· 1.	10.3	69%	23	5/29
2.	10.3	69%	23	5/29
3.	11.3	69%	23	5/29

Penetr	Tab ation Test Con	le IV.	or 4 mil Te	eflon
Toluen	ė		ν.	
j	Initial	BH	Temp	Date
1.	Thickness		℃	<b>('8</b> 6)
2.	3.5	78%	24	6/5
3.	3.7	78%	24	6/5
3,	3.7	78%	24	6/5
Hexan	2	i	10	
1,	12.2	68%	19	6/2
2.	13.4	68%	19	6/2
3.	12.7	68%	19	6/2
HCI		7		
1.	3.8	75%	25	7/2
2.	3.5	75%	25	7/2
3.	3.4	75%	25	7/2
Methyl	Ethyl Keto	ne		
1.	3.4	77%	24	6/5
2.	3.7	77%	24	ò/5
3.	3.7	77%	24	6/5
Water	· •			
1.	4.3	68%	19	6/2
2.	4.3	68%	19	6/2
3.	4.3	68%	19	6/2

Penetrat	Tation Test Condi	ole V.	5100/10 m	nil FFP
Toluer			1	
1. 2. 3.	initial Thickness 11 9.6 10.2	75% 75% 75%	Temp °C 24 24 24	Date ("83) 6/26 6/26 6/26
Hexan	e '	,		,
1. 2. 3.	9.9 9.7 10.1	65% 65% 65%	19 19 19	6/26 6/26 6/26
HCI				L
1. 2. 3.	8.9 8.5 7.0	75% 75% 75%	25 25 25	7/2 7/2 7/2
Methyl	Ethyl Keto	ne :	,	
1. 2. 3.	11.6 10.7 8	65% 65%	23 23 23	6/27 6/27 <b>6/27</b>
Water		, ,		
1. 2. 3.	11.8 13.9 11.8	<b>65%</b> 65%	<b>19</b> <b>19</b> 19	<b>6/26</b> 6/26

Table VI. Penetration Test Conditions for 6 inch Zippers					
Toluen	е .				
	Initial Thickness	RH	Temp °C	Date ('86)	
1. 2.	21.4 22.6	77% 77%	25 25	6/16 6/16	
Hexañe	,	•		1.0	
1. 2.	20.4 20.7	77% 60%	25 26	6/16 6/17	
HC!					
1. 2.	20.95 21.00	75% 75%	25 25	7/2 7/2	
Methyl	Ethyl Kel	lone			
1. 2.	20.00 19.90	60% 60%	25 25	6/17 6/17	

্ৰিable VII. Degradation Data for Butyl Rubber Gloves

Hexane	RH	73000	Temp 26	C 6/20/86
Thickness	Before	After	% Diff.	Elong.
1	11.1	10.6	-4.5	46.2
2 3	10.1	11.0	+8.9	60.8
3	10.1	8.0	-20.7	66.9
			avg 1.4	avg 57.96
Weight	Before	Change	Corrected	% Diff.
1	7.338	<b>D.572</b>	220	7.8
2	7.779	0.177	2.33	2.3
: <b>3</b>	7.838	0.112	2.36	14
				3.5 gvs
Dichloro	methar	re 73%	. 36¢.	. 6/20/86
Thickness	Before	After	% Diff.	Elong.
1	10.7	9.6	-10.1	63
2	10.3	11.3	+9.7	45
3	10.3	9.4	-9.1	31.5
			avg 9.8	avg 46.5
Weight	Before	Change	Corrected	% Diff.
1	7.815	0.212	2.56	9.25
2	8.054	0.140	2.42	5.80
3	7.863	0.192	2.35	8.20
				avg 7.75
, Methano	ol RH	73%	Temp 26	6C 6/19/86
/ We that it			المستداني الماميدات	
Thickness	Before	After	% Diff.	Elong.
Thickness 1 2	Before	After	% Diff.	Elong.
Thickness 1	Before 10.1	After 10.0 10.0 10.6	% Diff. -0.99 -0.99 0	Elong. 3.1 2.2 4.6
Thickness 1 2	Before 10.1 10.1	After 10.0 10.0 10.6	% Diff. -0.99 -0.99	Elong. 3.1 2.2
Thickness 1 2 3	Before 10.1 10.1	After 10.0 10.0 10.6	% Diff. -0.99 -0.99 0 avg 0.66	Elong. 3.1 2.2 4.6 avg 3.3
Thickness 1 2	Before 10.1 10.1 10.6	After 10.0 10.0 10.6	% Diff. -0.99 -0.99 0	Elong. 3.1 2.2 4.6 avg 3.3
Thickness 1 2 3 Weight 1	Before 10.1 10.1 10.6 Before	After 10.0 10.0 10.6 Change	% Diff. -0.99 -0.99 0 avg 0.66	Elong. 3.1 2.2 4.6 avg 3.3
Thickness 1 2 3 Weight	Before 10.1 10.1 10.6 Before 7.957	After 10.0 10.0 10.6 Change 0.05	% Diff. -0.99 -0.99 0 avg 0.66 Corrected 2.39	Elong. 3.1 2.2 4.6 avg 3.3  M Diff. 2.1

### Table VII. (continued) Degradation Data for Butyl Rubber Gloves

205.44			.,	
Acelone	. ≝ RH	7.3°°	Temp 250	6/19/86
Thickness	Before	Aîter	% Diff.	Elong.
1	11.6	11.0	-5.6	0.76
2	10.8	10.8	0	0.77
3	11.1	10.6	-4.5	0.76
			avg 3.4	avg 0.76
Weight	Before	Change	Corrected	% Diff.
1	7.679	0.021	2.30	0.9
2	7.798	0.040	2.34	1.7
3	7.338	0.570	2.20	7.8
				avg 3.2
Toluene	RH	72°。	Temp 276	6 18/86
Thickness	Before	After	% Diff.	Elong.
1	10.2	6.32	-38.04	115.60
2.	10.2	4.9	-51.96	96.20
3	10.3	5.4	-47.76	58.56
		a\	/g 45.92	avg 90.05
Weight	Before	Change	Corrected	% Diff.
1	7.861	0.49	2.36	20.8
2	8.030	0.59	2.41	24.6
3	8.038	1.29	2.41	53.5
				avg 32.96
Ethyl A	cetațe.	RH 7-2	6. Temp	27C 6/18
Thickness	Before	After	% Diff.	Elong.
1	10.7	10.7	0	.76
2	10.7	10.7	0	1.5
3	10.3	10.8	0	1.7
			avg 0	avg 0.84
Weight	Before	Change	Corrected	% Diff.
1	8.300	0.055	2.49	2.2
2	8.228	0.055	2.47	0.07
3	8.229	0.042	2.47	1.7
•	3.2.3		<del>_</del>	avg 1.32

Table VII.	(continued)
Degradation Data for	<b>Butyl Rubber Gloves</b>

Acetonit	rile R	H73%	Temp 25	6C 6'19'86
Thickness	Before	After	% Diff.	Elong.
1	10.8	10.5	-1.9	1.5
2	10.6	10.5	-0.94	1.5
3	10.3	10.3	. 0	3.4
		. (	avg 0.95	avg 2.1
Weight	Before	Change	Corrected	1 % Diff.
1	8.212	0.047	2.46	19
2	8.511	0.011	2.55	0.43
3	8.133	D.075	244	3.1
				avy 1.8
Tetrachlo	propthy	ir' analy	7202 - 27(	6, 18 86
Thickness	Before	After	% Diff.	Elong.
1	10.9	2.2	-79.82	tore
2	10.7	2.2	-77.60	tore
3	10.7	1.7	-84.11	tore
		<b>a</b> /	vg 80.51	tore
Weight	Before	Change	Corrected	% Diff.
1	8.320	2.32	2.50	92.8
2	8.045	.655	2.41	27.2
3	8.253	3.47	2.48	140
				avg 86.6
Diethylan	nine R	H62.5%	Temp	24C 6 18
Thickness	Before	After	% Diff.	Elong.
1	10.6	9.6	<b>-9</b> .6	<b>67.70</b>
2	10.0	9.6	-3.6	60.77
3	10.7	6.6	-38.25	69.23
		a	vg 17.22	avg 65.70
Weight	Before	Change	Corrected	d % Diff.
1	8.259	0.15	2.48	6.2
			2.42	1.6
	8.071	0.04	Z.42	1.0
2	8.071 8.220	0.Q4 0.14	2.42	5.8

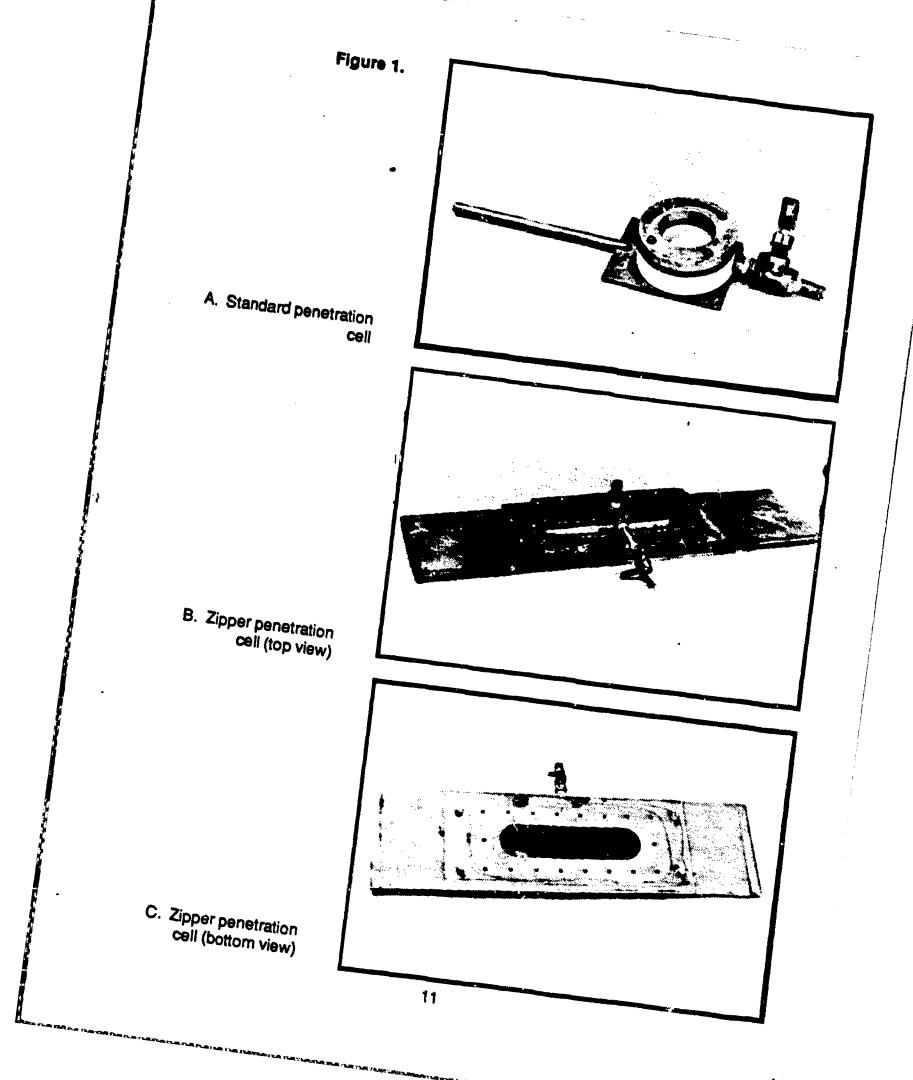
### Table VII. (continued) Degradation Data for Butyl Rubber Gloves

Degrad	ation Da	ta for But	yl Rubber G	iloves
Nitrobenz	ene R	RH62.5%	Temp	24°C 619
Thickness	Before	After	% Diff.	Elong.
1	10.6	10.8	-1.9	4.2
2 3	11.0	11.0	0	2.6
3	10.5	6.6	-37.1	2.9
			avg 13.0	avg 3.2
Weight	Before	Change	Corrected	% Diff.
1	8.259	0.05	2.47	0.6
Ž	8.129	0.41	2.44	7.7
3	8.251	0.26	2.42	2.0
- -	_			avg 1.4
Dimethyl	forman	ride (	52° o <sub>s,</sub> 210	C. 6 25 86
Thickness	Before	After	% Diff.	Elong.
1 *	10.6	9.9	-6.6	5.0
2	10.4	10.4	0	3.4
3	10.5	10.6	+.95	4.7
			avg 0.05	avg 4.7
Weight	Before	After	Corrected	% Diff.
1	8.212	6.615	2.46	64.9
2	8.122	.8.126	2.43	0.16
3	8.626	8.217	2.59	15.8
				avg 8.0
Carbon	Disulfic	le 62	.5°。 240	6/18/86
Thickness	Before	After	% Diff.	Elong.
1	10.2	9.9	-2.9	30
2	10.8	5.2	-52	38
3	10.7	8.9	-17	18
		a	vg 23.97	avg 28.7
Weight	Before	After	Corrected	% Diff.
1	8.160	8.213	2.448	2.17
		8.234	2.450	30.0
2	8.165	<b>U.LU</b> 4		
2 3	8.065	7.921	2.420	6.0

<sup>\*</sup> Glove label dissolved

### Table VII. (continued) Degradation Data for Butyl Rubber Gloves

Sodium	Hydrox	ide 62	2°6 2-1 C	6 26 86
Thickness	Before	After	% Diff.	Elong.
1	10.3	10.5	+1.9	1.5
2	10.0	10.0	0	0.38
· 3	10.6	10.5	-0.94	0.69
			avg 0.95	avg 0.86
Weight	Before	After	Corrected	% Diff.
1	8.226	8.232	2.47	D.24
2	8.200	8.320	2.46	4.8
· 3	8.342	8.126	250	8.5
				<b>200</b> 4.5
Sulfurio	Acid	.65%	23C	6 25 86
Thickness	Before	After	% Diff.	Elong.
1	10.6	10.6	0	none
2	9.96	9.76	-2.0	none
3	10.7	10.6	-0.93	none
		•	avg 0.98	-,,
Weight	Before	After	Corrected	% Diff.
1	8.307	8.359	2.49	2.09
2	7.949	.7.944	2.39	0.21
3	8.260	8.268	2.48	0.32
				avg 0.87
Tetrahydr	ofuran	62°。	21C.	6 18 86
Thickness	Before	After	% Diff.	Elong.
1	10.5	10.3	-1.9	142
2	10.3	8.8	-14.6	90.7
3	10.0	8.8	-11.2	47.6
			avg 9.2	avg 93.4
Weight	Before	After	Corrected	% Diff.
1	7.881	8.258	2.36	16
2	8.163	8.457	2.45	4
		_	2.40	11.1
3	7.994	7.261	2.40	11.1



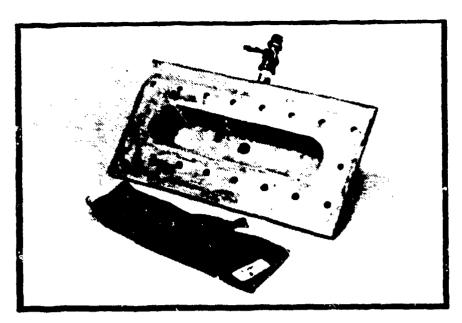
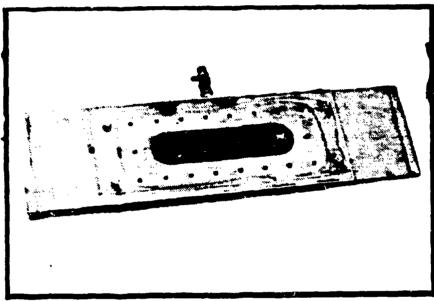


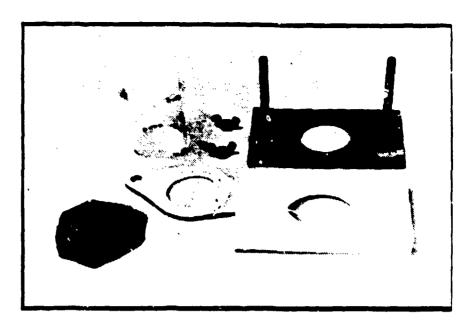
Figure 2.

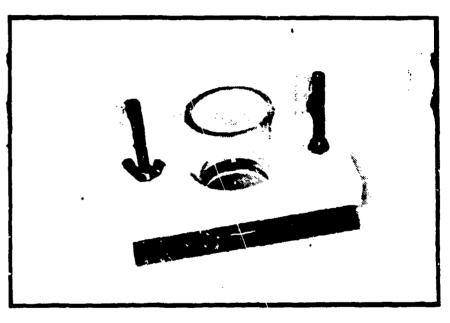




B. With zipper in place

Figure 3.
Standard degradation test apparatus





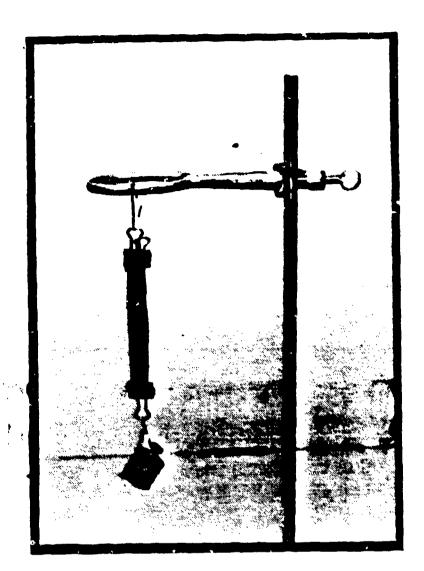


Figure 4.
Elongation test setup

### APPENDIX I PERMEATION TEST DATA FOR SEAM SAMPLES

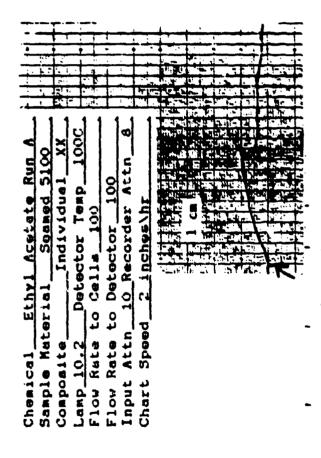
(Data Provided by Texas Research Institute Under Contract)

•	-	CRIPTION OF PROD	NICT BUAT HATED						
1.	DE 3	CKIPIION OF PROI	ACT PANTONIED						
	1:	TYPE: Teflon la							
	2:								
	3:	CONDITION BEFORE TEST: Unused, no visible imperfections							
	4:	MANUFACTURER:	Chemfab Corp.						
	5:		ICATION: Samed 5	00					
	6:		TURER DATE: N/A	<u> </u>					
	7:		SS: 40-50 m11						
		-							
	8:	DESCRIPTION:	laterial was buff co	lored.					
				يعيدون والرساطالة المالية والرابانية					
2.	TES	T METHOD							
	1.	TESTING LABORAT	CORY: Texas Research	Institute, 9063 Bee C	eves Road, Austin, TX				
	2.	ANALYTICAL METE	OD: Continuous pho	toionization detection	with a 10.20 av lamp.				
	3.	TEMPERATURE: 22		COLONIZECTOR GEOGETOR	W1011 & 10120 & 1880				
	٨.	COLLECTION MED							
	-								
	<b>3.</b>	COLLECTION SYST							
	6.	OT'SR CONDITION		s used./Detector Tempe					
	7.	DEVIATIONS FROM	ASTM F739 METHOD:	Flow rate to cell was	100 cc/min.				
3.	CHA	LLENGE CHEMICAL	1	: COMPONENT 2	: 3				
			_	•	•				
	1	CHEM NAME(s):	Tabul Assass	. N/A	: N/A				
•				N/A					
		CAS NUMBER(s):		: N/A	: N/A				
		CONC. (IF MIX)		: X/A	:N/A				
	4.	CHEMICAL SOURCE	E:EM Science	:N/A	:N/A				
4.	TES	T RESULTS							
	1.	DATE TESTED:	5-7-87						
		NUMBER OF SAMPLE		n A)	<del></del>				
		BREAKTHROUGH TIM		ut A/					
		MIN DETECTABLE I			······································				
		STEADY STATE PER		<u> </u>					
		SAMPLE THICKNESS							
	7.	SELECTED DATA PO	INTS N/A						
		TIME	: CONCENTRATIO	N : CONCENTRATION	: CONCENTRATION				
		1.	•	:	•				
		2.	<u>·</u>		<del></del>				
		3.		<del>~~</del>	<u> </u>				
			:	<u> </u>					
		4.			<u>;</u>				
		5	:	<b>:</b>	<u> </u>				
		6.	:	•					
		7.	•	•	:				
		8.	:		<u> </u>				
		9.	•	•					
		10.	2		THE RESERVE AND DESCRIPTIONS OF THE PERSON.				
		- <sup>-</sup>	<del></del>		<u> </u>				
		<b>ATITE ALESTICA</b>	.wa. a	• • • • • • • • • • • • • • • • • • • •					
	5.	OTHER OBSERVATIO	NS: Sample was sea	led in ASTM cell with	2 Neoprene gaskets.				
5.	Sou	RCE OF DATA							
		Sample was r	un by Denise McDons	1d on May 7. 1987.					

SCORE BOSSOSSIE EEK CAECOE DOON ON

Chemical Resistance Testing of Seamed 5100

### Ethyl Acetate Run A

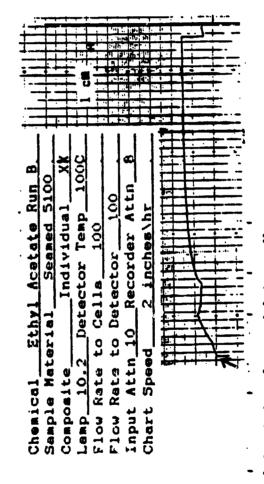


Ethyl Acetate charged into cells

			ORE TEST: Unused, 1 Chemfab Corp.	visible imperfect	tions	
	5:	PRODUCT IDENT	IFICATION: Seamed	100		
			CTURER DATE: N/A			
	7: 8:		NESS: 40-50 mil Material was buff (	colored.		
2.	TES	T METHOD				
			ATORY: Texas Resear			
		ANALYTICAL MET	THOD: Continuous pl	otolonization deter	ction with a	10.20 eV 1amp.
		COLLECTION ME				
		COLLECTION SYS				
			ONS: linch cell	as used./Detector	Temperature	= 100C.
	7.	DEVIATIONS FRO	OM ASTM F739 METHOD	Flow rate to cel	1 was 100 ce	/min.
						<del></del>
3.	CHA	LLENCE CHEMICAI	L 1	: COMPONENT 2	:	3
	1.	CHEM NAME (s)	Ethyl Acetate	: N/A		N/A
		CAS NUMBER(s):		: N/A		N/A
		CONC. (IF MIX		: N/A	i	N/A
	4.	CHEMICAL SOUR	CE: EM Science	: N/A	:	N/A
4.		T RESULTS  DATE TESTED:	5_7_07			
		NUMBER OF SAMP		Run R)		
		BREAKTHROUGH T		-tit 2/		
		MIN DETECTABLE				
	5.	STEADY STATE P	ERMEATION RATE N	/A	<del></del>	<del> </del>
	6.	SAMPLE TRICKNES	SS: 45 mils			
	7.	SELECTED DATA I	POINTS N/A			
		TIME	: CONCENTRAT	ON : CONCENTRA	TION . C	NCENTRATION
		1.	·	i concentration		MCENTRATION
		2.	:	<del></del>	<del></del>	
	;	3.	:	<del></del>	:	
	4	4.	:		:	
		5.	:	*	:	
		·	_:		_:	
		7.	<u> </u>	<del></del>	<u> </u>	
		3.	:	<del></del>	<u> </u>	
		10.	<u>.</u>	<del>:</del>	<u>:</u>	
		~	<del></del>		<del></del>	
	- <b>.</b> .	and 2 Teflo	ONS: Sample was so on gaskets.	LISS MICH III DELE	with I weop	rene gaskets
5.	SOIT	RCE OF DATA				<del> </del>
- •		Sample use	run by Danies Mana-	121d on May 7 1007		
			ran ny nentae uchol	124 UII REY /, 170/	•	
			run by Denise McCon			<del></del>

Chemical Resistanca Testing of Seamed 5100

Ethyl Acetate Run B



Ethyl Acetate charged into cells

l.	DES	CKIPIION OF PROD	DOCT EASTONIED			
	1:	TYPE: Teflon 1	emineted Nomey			
	2:		ERIAL CODE: 068		<del></del>	
	2: 3:			i, no visible imp	erfections	
	J. 4:	MANUFACTURER:		., 40 12020 227		
	5:		FICATION: Seam	A 5100		
			TURER DATE: N/A	:a 3100		
	6:		ESS: 40-50 mil			
	7:			o land		
	8:	DESCRIPTION: _I	Material was but	ri colored.		
2.	TES	T METHOD				
	1.					s Road, Austin, TX
	2.			s photoionization	detection wi	th a 10.20 eV lamp
	3.	TEMPERATURE: 2				
	4.	COLLECTION MED	IUM: N <sub>2</sub>			
	5.	COLLECTION SYS	TEM: N2			
	6.	OTHER CONDITION	NS: linch ce	ll was used. /Dete	ctor Temperat	ure = 100C.
	7.	DEVIATIONS FROM	M ASTM F739 MET	HOD: Flow rate t	o cell was 10	0 ec/min.
<b>L</b>	CHA	LLENGE CHEMICAL	1	-COMPON	ENT 2 :	3
	3	CHEM NAME (a) .	Ethyl Acetate	: N/A	•	N/A
٠.		CAS NUMBER(s):		3/4		N/A
:		CL. T. (IF MIX)		N/4		N/A
	4.	•		: N/A		N/A
•		T RESULTS  DATE TESTED:	5-7-87			v,
			ES TESTED: On	(Pup C)	<del></del>	
		BREAKTHROUGH TI			<del></del>	
		MIN DETECTABLE		· · · · · · · · · · · · · · · · · · ·		
		STEADY STATE PE		N/A		
		SAMPLE THICKNESS		N/A		
	-	SELECTED DATA P				
		TIME	: CONCENT	RATION : CON	ENTRATION :	CONCENTRATION
		1.	<u>:</u>	<u> </u>	<u> </u>	
		2.	:		:	
		3.	•	*	:	
		4.	:	:	•	
		5.	:		:	
	,	6.	•	•	:	
	•	7.	:	:	:	
	1	8.	:		:	
	9	9.	:	:		
		10.	:	:		<del></del>
	·				i-	
	8. (	OTHER OBSERVATION and 2 Teflor		s sealed in ASTM	cell with 2 N	deoprene gaskets
				<del></del>		
•	SOU	RCE OF DATA	run by Denise M	oDonald on May 7	. 1987.	

# Chemical Resistance Testing of Seamed 5100

## Ethyl Acetate Ruin C

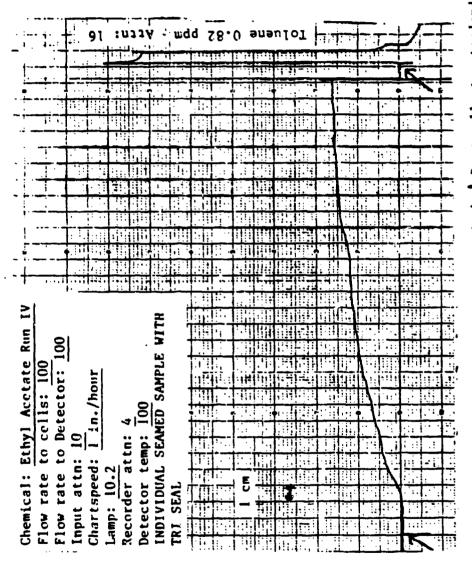
	7' 1'		ENTRE THE CONTROL OF
Chemical Ethyl Acetate Run C Sample Material Seamed 5100 Composite Individual XX	Lamp 10.2 Detector Temp 100C Flow Rate to Cells 100 Flow Rate to Detector 100	Input Attn 10 Recorder Attn 8 Chart Speed 2 inches/hr	

Ethyl Acetat's charged into cells

3:	BOUTE OF THE		ed Nomex			····	
	PROTECTIVE N					<del></del>	<del></del>
			ST: Unused, no	visible i	mperfecti	ons	
	MANUFACTURE						
			ION: Seamed 510	0			
6:	LOT OR MARL'F	FACTURER	DATE: N/A				
7:	NOMINAL THIC	CKNESS:	40-50 mil				
8:	DESCRIPTION:	Mater	ial was buff col	ored.			
TES	ST METHOD						
			Texas Research				
	ANALYTICAL N			oionizati	on detect:	ion with a	10.20 eV lan
	TEMPERATURE:						
	COLLECTION !						
5.	COLLECTION S	SYSTEM:	N <sub>2</sub>				
			l inch cell was	used. /	Detector '	Temperatur	e = 100C.
7.	DEVIATIONS I	FROM AST	F739 METHOD:	Flow rate	was 100	cc/min.	
CH/	ALLENGE CHEMIC	CAL	1	: COMP	ONENT 2	:	3
				:		:	
1.	CHEM KANE (s)	): Ethi	rl Acetati	:	N/A	:	N/A
2.	CAS NUMBER (	s): 141	-78-6	:	N/A		N/A
	CONC. (IF M		. <del> </del>		N/A		N/A
	CHEMICAL SOL				N/A	<del></del>	N/A
•	DATE TESTED:		B6 STED: One (Run	IV)			
2. 3. 4. 5. 6.	BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICKS	TIME: C LE LIMIT PERMEAT NESS:	.16 ppm ION RATE 1.08 ug 7 mils	/cm²/hr			
2. 3. 4. 5. 6.	BREAKTHROUGH MIN DETECTABL STEADY STATE	TIME: C LE LIMIT PERMEAT NESS:	.16 ppm ION RATE 1.08 ug 7 mils	/cm²/hr			
2. 3. 4. 5. 6.	BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICKS SELECTED DATA TIME	TIME: C LE LIMIT PERMEAT NESS:	.16 ppm ION RATE 1.08 ug 7 mils	: <b>c</b> o	NCENTRATIO	ON : CO	NCENTRATION
2. 3. 4. 5. 6.	BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICKS SELECTED DATA	TIME: LE LIMIT PERMEAT NESS: A POINTS	.16 ppm ION RATE 1.08 ug 7 mils		NCENTRATIO	ON : CO	NCENTRATION
2. 3. 4. 5. 6.	BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICKS SELECTED DATA TIME 1.	TIME: LE LIMIT PERMEAT NESS: A POINTS	.16 ppm ION RATE 1.08 ug 7 mils	: <b>c</b> o	NCENTRATIO	ON : CO	NCENTRATION
2. 3. 4. 5. 6.	BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICKS SELECTED DATA  TIME  1. 2. 3. 4.	TIME: CLIMIT PERMEAT NESS: A POINTS	.16 ppm ION RATE 1.08 ug 7 mils	: <b>c</b> 00	NCENTRATI(	<u>:</u>	NCENTRATION
2. 3. 4. 5. 6.	BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICK SELECTED DATA  TIME  1. 2. 3. 4. 5.	TIME: CLIMIT PERMEAT NESS: A POINTS	.16 ppm ION RATE 1.08 ug 7 mils	: <b>c</b> 00	NCENTRATI(	<u>:</u>	NCENTRATION
2. 3. 4. 5. 6.	BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICKS SELECTED DATA  TIME  1. 2. 3. 4. 5. 6.	TIME: LE LINIT PERMEAT NESS: A POINTS	.16 ppm ION RATE 1.08 ug 7 mils	: œ	NCENTRATIO		NCENTRATION
2. 3. 4. 5. 6.	BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICK SELECTED DATA  TIME  1. 2. 3. 4. 5.	TIME: LE LINIT PERMEAT NESS: A POINTS	.16 ppm ION RATE 1.08 ug 7 mils	: 00	NCENTRATIO		NCENTRATION
2. 3. 4. 5. 6.	BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICKS SELECTED DATA  TIME  1. 2. 3. 4. 5. 6.	TIME: LE LIMIT PERMEAT NESS: A POINTS	.16 ppm ION RATE 1.08 ug 7 mils	: 00	NCENTRATIO		NCENTRATION
2. 3. 4. 5. 6.	BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICKS SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8.	TIME: LE LIMIT PERMEAT NESS: A POINTS	.16 ppm ION RATE 1.08 ug 7 mils	: 00	NCENTRATIO		NCENTRATION
2. 3. 4. 5. 6.	BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICKS SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9.	TIME: LE LIMIT PERMEAT NESS: A POINTS	.16 ppm ION RATE 1.08 ug 7 mils	: 00	NCENTRATIO		NCENTRATION
2. 3. 4. 5. 6.	BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICKS SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8.	TIME: LE LIMIT PERMEAT NESS: A POINTS	.16 ppm ION RATE 1.08 ug 7 mils	: 00	NCENTRATIO		NCENTRATION
2. 3. 4. 5. 6. 7.	BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICKS SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	TIME: LE LIMIT PERMEAT NESS: A POINTS : : : : : : : : : : : : : : : : : : :	.16 ppm ION RATE 1.08 ug 7 mils	: 00			
2. 3. 4. 5. 6. 7.	BREAKTHROUGH MIN DETECTABI STEADY STATE SAMPLE THICKS SELECTED DATA  TIME  1. 2. 3. 4. 5. 6. 7. 8. 9. 10. OTHER OBSERVA	TIME: LE LIMIT PERMEAT NESS: A POINTS : : : : : : : : : : : : : : : : : : :	.16 ppm ION RATE 1.08 ug 7 mils N/A CONCENTRATION	: 00			

# Chemical Resistance Testing of Seamed 5100

### Ethyl Acetate Run IV



Ethyl Acetate charged into cells

Switched from cells to standard gas

1.	DES	CRIPTION OF PRODU	ICT EVALUATED			
	1:	TYPE: Teflon law	inated Nomex			
		PROTECTIVE MATER			- <del>11 </del>	
				visible imperfectio	ns	
		MANUFACTURER: C				
	5.	PRODUCT IDENTIF	CATION: Seamed 510	00		
		LOT OR MANUFACTU				
		NOMINAL THICKNES				
			aterial was buff col	lored.		
2.	TES	T METHOD			<del></del>	
	1.	TESTING LABORATO	ORY: Texas Research	Institute, 9063 Bee	Caves	Road. Austin
				oion zation detecti		
		TEMPERATURE: 22-				
		COLLECTION MEDI			<del></del>	<del> </del>
	-	COLLECTION SYSTI				
				used./Detector Ten		a = 100 C
	7.	DEVIATIONS FROM	ASTM F739 METHOD:	Flow rate to cell	was 100	cc/min
<u>.</u>		LLENGE CHEMICAL	1	: COMPONENT 2		3
_			•	:	:	
		CHEM NAME(s):		_: <u>N/A</u>	:_	N/A
		CAS NUMBER(s):		: N/A	:	N/A
		CONC. (IF MIX)		: N/A	:	N/A
	4.	CHEMICAL SOURCE	EM Science	: N/A	:	N/A
	2. 3. 4. 5. 6.	NUMBER OF SAMPLE	E: No breakthrough IMIT .17 ppm MEATION RATE N/A : 47 mils	was observed in 4.	hours	
		TIME 1.	: CONCENTRATIO	N : CONCENTRATIO	ON :	CONCENTRATIO
		2.	•	:	<del></del>	
		3.	:	:	:	
		4.		:	:	
		5.	:	<b>†</b>	:	<del></del>
		6.	:	:	:	<del></del>
		7.	:	:	<u> </u>	
			:	· · · · · · · · · · · · · · · · · · ·	<del></del>	·
		9.	:		<del></del>	·
		10.	<u>·</u> :	<del>:</del>	<del></del>	
		<del></del>			<u>-</u> _	
	8.	OTHER OBSERVATIO 1/4" expanded	NS: Sample was sea P.T.F.E. cord.	led on both sides o	ASTM	cell with
		——————————————————————————————————————		<del>*</del>		<del></del>
t	60.	RCE OF DATA				
5.	SOL	32Mn   4 Uac	run by Denise McDon	ald on June 3, 1987	•	<del></del> -
5.	SOL	Dampie was				
5.	SOU	Dampte was				
5.	SOL					
5.	SOU					
5.	SOU	Sample was				

# CHEMICAL RESISTANCE TESTING OF SEAMED 5100

## ETHYL ACETATE RUN D

	Acen: 16 to to to to to to to to to to to to to
Chamical Ethyl Acetate Run D Sample Material Seamed 5100 Composite Individual XX Lamp 10.2 Detector Temp 100C m Flow Rate to Cells 100	Flow Rate to Detector 100 Input Attn 10 Recorder Attn 8 Chart Speed 2 incheshr

Ethyl Acetate charged into cells

Switched from cells to standard gas

### APPENDIX J

### INTERIM REPORT OF SUIT EXHAUST VALVE TESTING

(Contractor Report by Lawrence Livermore National Laboratory)



REPORT TO USCS

Total: Fr. Granagen

# Safety Science Group



Hazards Control Department

**Lawrence Livermore National Laboratory** 

# Evaluation of the Performance of One-Way Valves Used in Chemical Protective Suits\*

# Introduction

We are reporting preliminary results from a study on low-pressure vent valves that we are conducting for the U.S. Coast Guard. Test results from four valves will be discussed here. The valve currently used in the Coast Guard totally-encapsulating chemical protective (TECP) suit is made by Stratotech Corporation. A second suit valve that was evaluated is made in Sweden by Trelleborg. Then, to provide a comparison for the evaluation, we included two valves that are used in respirators. These valves are made by MSA Corporation, and included a standard flapper valve and a pressure demand valve.

### Background

The U.S. Coast Guard has developed a new totally-encapsulating suit for the protection of personnel during chemical spill response. Low-pressure one-way vent valves are used in the suit to allow escape of exhaust air from the occupant's self-contained breathing apparatus, and to maintain a small positive pressure (1 to 3 inches water column pressure) inside the suit. This latter feature minimizes diffusion or penetration of chemical vapors through poor seams, material punctures, or improperly closed zippers. Satisfactory operation of these valves is critical to the functionality and protective qualities of encapsulating suits.

While protection factors have been measured for the overall suit in operation, there has been no attempt to exclusively determine suit exhaust valve protection factors. Furthermore, recent overall suit testing has shown differences in suit protection factors when the internal suit probe is located near the breathing zone as compared to locating the probe internally near the exhaust valve. This information indicates that diffusion of the challenge agents through the suit exhaust valves may be significant.

<sup>\*</sup>This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract No. W-7405-ENG-48.

# Experimental Considerations

We prepared an experimental system that would provide for a high degree of control over the valve environment. A small cast aluminum box (roughly 9 inches long by 5 inches wide by 6 inches high) was fitted with several openings to provide for breathing and test air inputs, analytical sampling ports and environmental measurements (pressure, temperature). A diagram of the box is shown in Fig. 1. The box was constructed so that a plastic plate could be inserted between the two halves. At the center of the plate, a recessed orifice was machined that allowed the different valves to be inserted with a leak tight seal. When the box and plate were assembled, the valve was positioned to function as the only conduit between the two resulting compartments. One compartment could then function as the "inside" of a TECP suit, and the other as the "outside."

The complete assembly was tested for leakage with a Stratotech valve installed. A solid cap was threaded onto the inside half of the valve. The outside compartment was filled with methane from a lecture bottle. With the pressure differential between the two chambers at zero, no methane was detected within the second (inside) chamber. We interpreted this data to that the test box was leaktight when the insert plate containing a valve was installed. Conversely, with the cap removed, future measurement of methane in the inside chamber would have to indicate the valve as the source of penetration. A diagram of the Stratotech valve in this testing arrangement is shown in Fig. 2.

A schematic of the complete test assembly is given in Fig. 3. The top left of the diagram shows a source of air that allowed precise control of flow, temperature, and relative humidity (Miller-Nelson Research, HCS-301). At the top center is shown a source (lecture bottle) of test gas (methane) which can be added to the air flow through a mass flow controller. The mixture of air and test gas is passed through a calibrated infrared analyzer (Foxboro Corporation, Miran 1A) to measure test gas concentration. When pure methane was used in this work, the air source and infrared analyzer were disconnected and the methane from the lecture bottle passed through the mass flow controller and then directly to the test chamber.

The previously described test box is shown as a divided box in the lower right of the schematic. Also shown are the probes for differential pressure measurement between the two chambers of the box. In addition, a single pressure transducer could be placed in either part of the box to measure chamber pressure relative to the atmosphere. Finally, the exhaust flow from the lower half of the box was checked for temperature with a thermistor probe (YSI Series 700, Yellow Springs Instrument Company) and a digital thermometer (Cole-Parmer Model 8502-20). A comparison of temperature was continually made between the test box exhaust flow and either the controlled air source or the room air. The concentration of test gas within the inside chamber of the box was measured with a calibrated total hydrocarbon analyzer (Beckman, Model 400, FID principle).

We chose methane as a test gas for several reasons. First, under the conditions of this experiment, this gas is inert to the tenterials used in the several valves. Second, this hydrocarbon can be detected at very low levels with conventional methods. In addition, the THC can be calibrated to tensure methane over a very large linear dynamic range. Finally, the measured diffusion coefficient for methane is on the same order of magnitude as that reported for hydrogen<sup>1,2</sup>, and gaseous diffusion of the compound is therefore quite rapid.

## Test Results

Our first test was to observe the valves under static conditions, i.e., without use of simulated breathing. A valve was installed in the plastic insert, and the plate was assembled between the box halves. The outside chamber of the test box was filled with pure methane. Leakage rates were determined from the change in the observed concentration of methane in the inside chamber over a specified time period. The calculated volume of the upper chamber is  $1616 \text{ cm}^3$  (24.4 cm x 13.0 cm x 5.1 cm). If we take the definition of parts-per-million by volume to be ppmv = [(vol. of analyte) / (vol. of dilutant)] x  $10^6$ , and then make the appropriate substitutions, the leak rates can be determined.

Two valves were tested in this manner, the Stratotech valve, and the MSA positive pressure valve. After an initial measurement at a pressure differential of zero, compressed air was forced to the inside chamber through a precision valve, and the new concentration recorded over time at the higher pressure. The result of compression probleminary testing is shown in Fig. 4. Our technique shows an observable leak of the outside gas into the inside chamber. To provide comparison, we make reference to the current Bureau of Mines Standard for Respiratory Protection Devices. The standard used by the Bureau of Mines is the same as that reported in use by the Chemical Warfare Service during WHII. In this standard, the designated respirator exhalation valve leakage is not to exceed 30 ml min<sup>-1</sup> at a suction of 25 mm of water column height. The implication from this standard is that there is measurable leakage through respirator exhaust valves under normal operating conditions. To provide data comparable to the respirator standard, the suit's one-way went valves would have to be tested in the same manner.

Dur next experiment was to observe the valves during the simulated breathing provided from a breathing machine. We tested four valves at two separate breathing rates, 10 and 20 breaths min<sup>-1</sup>, respectively. In all cases except one, a constant inside concentration of methane was achieved. Our technique was to observe the background signal of the THC analyzer with the breathing machine on, and then to fill the outside compartment of the box with methane. The internal concentration of methane would rise and then level off at an equilibrium value, which is the data reported in Fig. 5. The exception occurred with the MSA pressure demand valve at the 10 cycle min<sup>-1</sup> breathing rate. Over the 10-min duration of the test, the internal concentration continued to rise (at a rate of 4.8 µl min<sup>-1</sup>).

In all the other cases except one, we observed the internal concentration to fluctuate within a few ppmv. The single exception was that the Trelleborg valve exhibited large oscillations around an average internal concentration. It is these (sawtooth appearing) concentration variations that are shown in the bar graph of Fig. 5. Finally, in addition to the small sinusoidal type fluctuations seen in the other valves, and the large variation seen in the Trelleborg valve, there was in every case a very small oscillation

superimposed on the general trend. This occurred in exact sequence with the cycles of the breathing machine. We could only attribute this fluctuation to the immediate changes that occurred when the valve opener and closed.

We also made observations of the differential pressure during operation of the breathing machine. This was done for each valve and was recorded as a positive pressure within the inner chamber relative to the pressure within the outside chamber. The data are presented graphically in Fig. 6. This data separated the four valves by pairs. The two valves that were controlled by spring tension (to open only after a certain pressure threshold was attained) allowed larger internal chamber pressures. The two flapper type valves maintained lower pressures. The pressures seen were higher at faster breathing rates, and again the flapper type valves maintained lower pressure than the spring tension valves.

# Conclusions

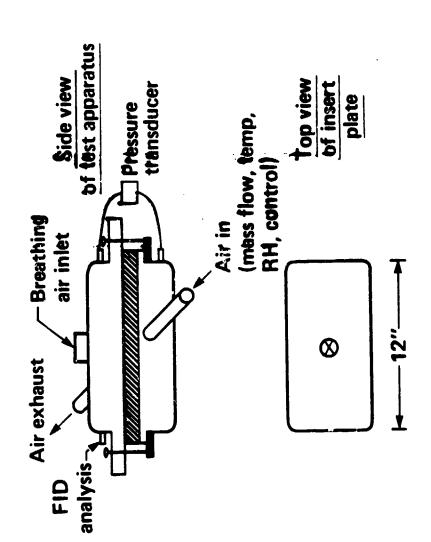
We have developed a method to test TECP vent-valves. This method isolates the valve between two chambers and tests for leakage of the valves by measuring concentration of a test gas in the inside chamber of the test box. The use of a removable plate that contains a valve installed in a leaktight manner allows for simple and rapid exchange of valves for testing. Our preliminary data indicates that there is leakage of the test gas under normally closed conditions (zero differential pressure). When the pressure on the inside chamber is increased, this leak rate is observed to decrease. One conclusion that follows from these test results is that the vent valves may be a major leak source for the intact suit. Further research is necessary to allow more general conclusions to be drawn.

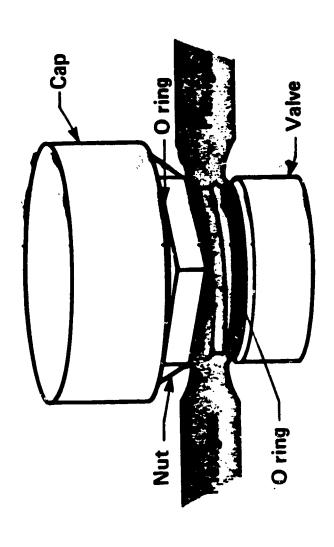
# References

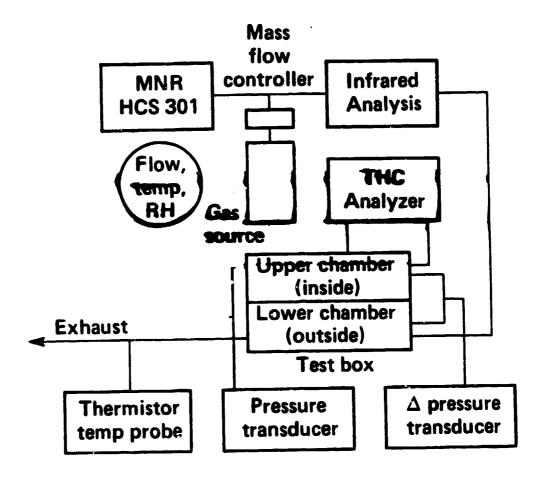
- 1. W.A. Wakeham D.H. Slater, J. Phys b: Atom. Molec. Phys., Vol. 6, 1973, pp. 886-896.
- 2. CRC Handbook of Chem. and Physics, 61st Ed., R.C. Weast, ed., p. F-62.
- 3. Federal Register, 37 (59), part II, par. 11.162-2 (1972).
- 4. L. Silverman, R.C. Lee, and G. Lee, "Fundamental Factors in the Design of Protective Respiratory Equipment", Office of Scientific Research and Development, Report No. 1864, 1943, p. 6.

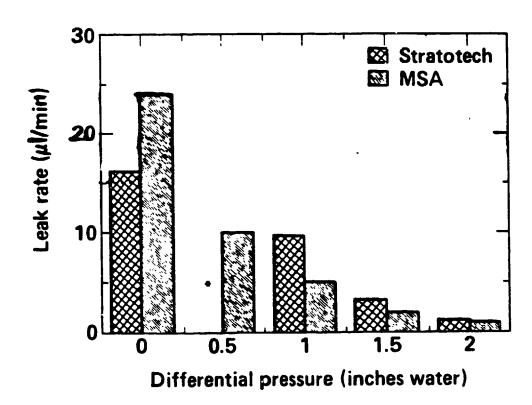
# Figure Captions

- Figure 1. A schematic of the cast aluminum box that was used in the valve testing experiment.
- Figure 2. drawing of the Stratotech valve as it appears when installed in the  $Plexiglas^R$  plate.
- Figure 3. Schematic of the experimental test system used in the study on oneway vent valve performance.
- Figure 4. Graphic representation of the leak rates observed during static leak testing of one-way went valves.
- Figure 5. Graphic representation of the concentration of methane observed in the "inside" chamber of the test box during simulated breathing.
- Figure 6. Differential pressure observed with different valves during breathing machine operation.

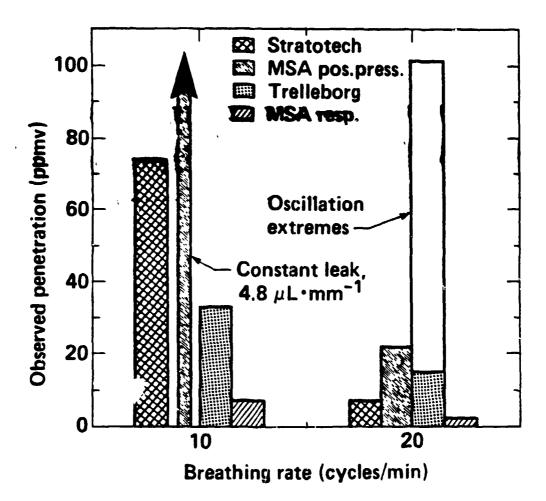


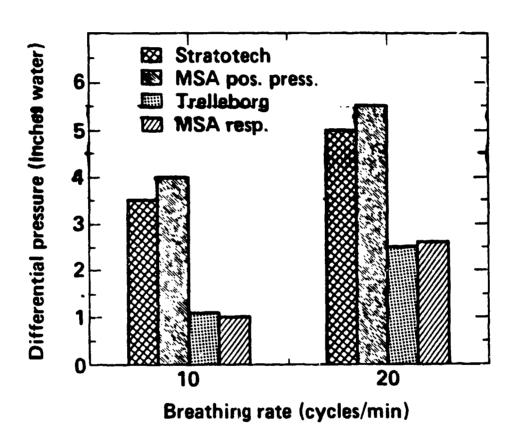






\* Stratotech data not available





# APPENDIX K

# EVALUATION OF SUIT INTEGRITY IN PROTECTION FACTOR TESTS

(Contractor Report by Lawrence Livermore National Laboratory)



TECP SUIT TEST PROTOCOL

for

USCG/USFA PROJECT

# Safety Science Group



Hazards Control Department

**Lawrence Livermore National Laboratory** 

# Introduction

The need to provide complete encapsulation of workers to allow them to carry out their jobs safely is becoming very commonplace. Such jobs as hazardous material response, toxic waste dump cleanup, and chemical manufacture and use require complete encapsulation of employees routinely or during accidents. With the increase use of complete encapsulation in the workplace, a high degree of performance is now expected from commercially available totally-encapsulating chemical protective (TECP) suits. This high degree of performance was also identified by John B. Moran, Head, Division of Safety Research, National Institute for Occupational Safety and Health, when the referred to chemical protective clothing as "the last line of defense" for the worker-

A TECP suit is made up of many components (Fig. 1). Many of these components are in themselves individual items of chamical protective clothing for which chemical permeation data is available. Some items however, such as suit closures, vent valves, lens material, suit membranes, and seams are unique to a TECP suit and therefore require individual chemical permeation testing. This type of data however, does not provide the user with a measure of complete TECP suit integrity. To measure the complete integrity and performance of TECP suits, quantitative chamber testing can be used. By simultaneously using both an aerosol and gas test agent one can determine the TECP suit leak rate accurately. If these measurements are made while the suit is being worn by a person performing a series of exercises, a good estimate of field TECP suit performance can be obtained.

# Experimental Setup

To measure TECP suit leak rates accurately separate gas (Freon<sup>R</sup> 12) and

aerosol polyethylene glycol molecular weight 400 (PEG 400) detection systems will be used. The Freon<sup>R</sup> 12 subsystem uses a man-test chamber concentration of 1000 ppm as determined by a Wilks Model 1A infrared spectropholometer. The interior of the TECP suit is monitored for Freon<sup>R</sup> 12 intrusion using a Varian Model 2700 gas chromatograph (GC) equipped with an electron capture detector (ECD). Since the GC/ECD detection limit for Freon<sup>R</sup> 12 is 0.01 - 0.001 ppm, this measurement technique enables one to measure an intrusion coefficient of 100,000 to 1,000,000. A gas sampling valve is used to collect discrete samples from the interior TECP suit air approximately every two minutes.

To measure the aerosol concentrations in the man-test chamber (Fig. 2) and within the TECP suit a Phoenix Precision Instrument's Model 3M 7000 forward light scattering photometer will be used. The test aerosol of PEG 400 will be generated using a Laskin nozzle generator which creates a mass median aerosol diameter aerosol of approximately 0.68 )m, sg = 2.10. Aerosol concentrations within the man-test chamber will be  $25 \pm 5$  mg/M<sup>3</sup>. A sample of two liters per minute is withdrawn from the suit and passed through the photometer providing a real time measure of aerosol concentrations within the suit.

Sample line penetrations into the TECP suit will take advantage of existing penetrations for such things as airline cooling or communication. If these types of penetrations are not available a cuff ring with sampling port will be attached using a removable glove connection. If these methods are not applicable a hole will be cut in the suit and a sampling line will be sealed into the suit. The last method is the least desirable but necessary when no other sampling line penetration is available. The minimum number of connections necessary to connect the sampling line to the proper monitoring instrument will be used with a minimum length of sampling line. During a

typical test, samples of both Freon<sup>R</sup> 12 and PEG 400 will be taken simultaneously and used to determine TECP suit performance.

A series of light exercises have been chosen to stress the suit in a manner similar to typical work routines. Each exercise is carried out for two minutes completing the prescribed number of repetitions.

- o Stand in place.
- o Raise hands from waist to above the head, completing at least 15 raising motions per minute.
- b Walk in place completing at least 15 raising motions of each leg per minute.
- Touch the toes, making at least 10 complete motions of the arms from above the head to the toes per minute.
- o Perform deep knee bends, making at least 10 complete standing and squatting motions per minute.
- o Repeat complete exercise series.
- o Exit man-test chamber.

The exercise series requires approximately 20 minutes plus donning and doffing time. A 30-minute SCBA bottle will work some of the times, but a 60-minute bottle is preferred.

Two USCG/USFA TECP suits will be evaluated along with single suits from four commercial manufacturers.

# Data Analysis

The output from the photometer, GC/ECD and infrared spectrophotometer will be collected on a DEC LSI 11/23 lab computer. Suit intrusion coefficients will be calculated for both aerosol and Freen 12 test agents and their results compared. Graphs showing these intrusion coefficients will be included in the final report.

To determine if various components of the TECP suit are leaking the tracernal samplings lines will be placed in close proximity to the component in question.

# Final Report

A final report will be prepared summarizing the results of the various TECP suits along with any conclusions with reference to specific suit component performance.

<sup>1</sup> Intrusion Coefficient = Outside Concentration
Interior Suit Concentration

# Suit Design





Suit closure

Vent valves

Suit membrand

Seams

Gloves

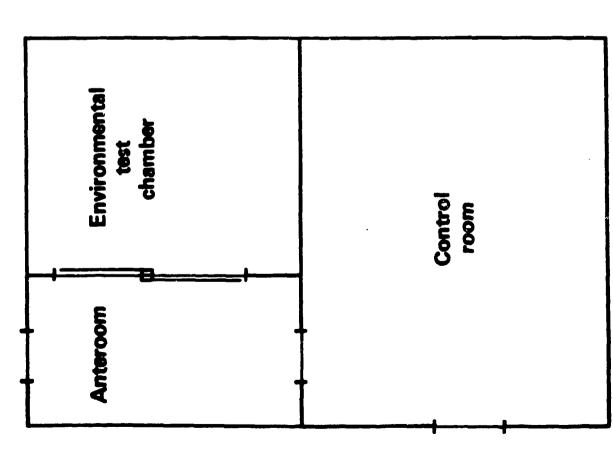
Boots



The configuration and design of Type 1 and Type totally-encapsulating chemical-protective suits. Figure 1.

Type

# Safety science group environmental test facility



Test atmospheres: Freen TM 12 (gas) PEG 400 (serosol)

Stress testing: Treadmill

# Monftoring:

- GC with electron capture detectors
- <u>a</u>
- Photometer
- Optical particle sizar
- Size/charge particle counter
- Humidity monitor
  - Air flow monitor
    - Pressure monitor
- Heaft rate monitor

# Computer interface:

• DEC LSI 11/23



TECP Suit Man-Test

Results for the USCG/USFA/OSHA

Project

# Safety Science Group



Hazards Control Department

Lawrence Livermore National Laboratory

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Human Subjects Approval
Experimental Description
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Aerosol Leak Detection System
Suit Modifications
Exercise Protocol
Internal Pressure Monitoring
Vent Volume Monitoring
Data Analysis
Experimental Results
Discussion
Conclusion.

# Introduction

In our report titled, "TECP Suit Test Protocol for USCG/USFA Project" we discussed the general design of a totally encapsulating chemical protective (TECP) suit and the test method we have developed to evaluate the TECP suit performance. In this report we will summarize the results from our test on the new U.S. Coast Guard's TECP suit made from Teflon $^R$ -coated Nomex $^R$  fabric (Figure 1).

# Human Subjects Approval

The Lawrence Livermore National Laboratory (LLNL) is operated by the University of California for the U. S. Department of Energy (DUE). DUE requires that all experiments involving haman volunteers at LLNL must be reviewed by the Human Subjects Committee and found acceptable. The experimental test procedures described in this report have been reviewed and approved by the Human Subjects Committee.

# Experimental Description

# Freon Leak Detection System

To measure TECP suit leak rates accurately, a separate gas (Freon<sup>R</sup> 12) and aerosol [polyethylene glycol molecular weight 400 (PEG 400)] detection systems is used. The Freon<sup>R</sup> 12 subsystem uses a man-test chamber concentration of 1000 ppm as determined by a Wilks Model 1A infrared spectrophotometer. The interior of the TECP suit is monitored for Freon<sup>R</sup>12 intrusion using a Varian Model 2700 gas chromatograph (GC) equipped with an electron capture detector (ECD). The sampling time for the GC sampling loop is two minutes. In an upgrade of this system a second sampling loop

and ECD detector is being added. Thus, by alternating the sampling cycles, a sample can be collected approximately every minute. Since the GC/ECD detection limit for Freon<sup>R</sup> is 0.01 - 0.001 ppm, this measurement technique enables SSG to measure a suit intrusion coefficient of 100,000 to 1,000,000.

# Aerosol Leak Detection System

The aerosol concentrations in the man-test chamber and within the TECP suit were measured using a Phoenix Precision Instrument's Model JM 7000 forward light scattering photometer. The test aerosol of PEG 400 was generated using a Laskin nozzle generator which treated a mass median erosol diameter of approximately 0.68 µm, sg = 2.10. Aerosol concentrations within the man-test chamber were 25 ± 5 mg/M<sup>3</sup>. A sample of two liters per minute was withdrawn from the suit and passed through the photometer, providing a real time measure of aerosol concentrations within the suit.

# Suit Modifications

Sample line penetrations into the TECP suit would normally take advantage of existing penetrations for such things as airline cooling or communication. Since no penetration was available in the U.S. Coast Guard TECP suit, a hole was cut in the suit to enable the mounting of a sealed sampling line. The hole was located in a reinforced section in the front waist area of the suit. The minimum number of connections necessary to connect the sampling line to the proper monitoring instrument were used with a minimum length of sampling line. During the TECP suit test, samples of both Freon<sup>R</sup> 12 and PEG 400 were taken simultaneously and used to determine TECP suit performance.

# Exercise Protocol

A series of light exercises were chosen to stress the suit in a manner similar to typical work routines. Each of the following exercises was carried out for two minutes completing the prescribed number of repetitions. The exercises were carried out in the Safety Science Group's man-test chamber (Figure 2).

- o Stand in place.
- o Raise hands from waist to above the head, completing at least 15 maising motions per minute.
- o Walk in place completing at least 15 raising motions of each leg one minute.
- o Perform deep knee bends, making at least 10 complete standing and squatting motions per minutes.
- o Touch the toes, making at least 10 complete motions of the arms from above the head to the toes per minute.
- o Repeat complete exercise series.
- o Exit man-test chamber.

The exercise series required approximately 20 minutes plus donning and doffing time. A 30-minute SCBA bottle provided enough experimental time, but a 60-minute bottle was used because of its additional weight and duration.

# Internal Pressure Monitoring

The pressure inside the TECP suit was measured using a Validyne model, P24 pressure transducer with a range of  $\pm 15$ " water gauge (wg) and an accuracy  $\pm 0.08$ " wg.

# Vent Volume Monitoring

The volume of air exhausted from the TECP suit was measured using a Kurtz Instruments, Inc. flow meter equipped with a probe for Model 505 which was placed in a specially designed tube.

# Data Analysis

The output from the photometer, GC/ECD, infrared spectrophotometer, pressure transducer, and flow monitor was collected on a DEC LSI 11/23 lab computer at a sampling rate of 250 ms per entry. Suit intrusion coefficients or protection factors were calculated for both aerosol and Freon 12 test agents. Graphic output from the computer was plotted as the concentration of aerosol penetrating the suit interior (suit penetration) during the various exercises. Real time pressure and flow traces throughout the various exercises were also recorded. The actual results are presented in the Experimental Results Section and a discussion of their meaning is presented in the Discussion and Conclusion Sections.

<sup>1</sup> Intrusion Coefficient = Outside Concentration
Intrusion Coefficient = Interior Suit Concentration

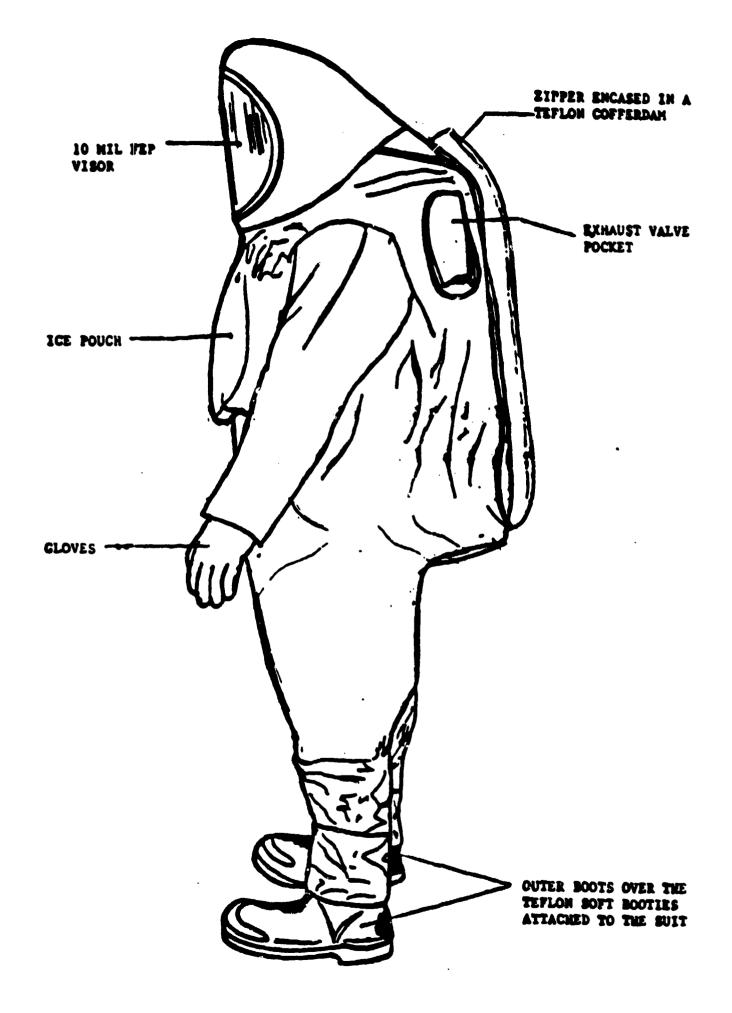


Figure 1. United States Coast Guard's totally encapsulating chemical protective suit design. \_5\_

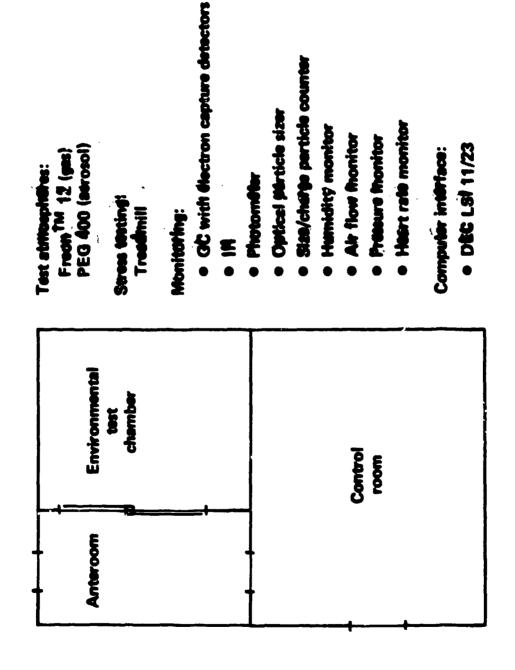
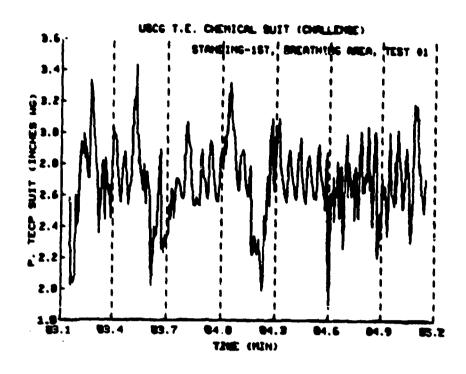


Figure 2. Saftey Science Group man-test chamber.

# **Experimental Results**

Figures 3 through Figure 39 and Table 1 present the various experimental parameters recorded during each of the three test runs. Due to start up conditions and monitoring or recording failures, some experimental parameters were not recorded. All experimental data which was collected is presented, nothing has been omitted by the investigator.



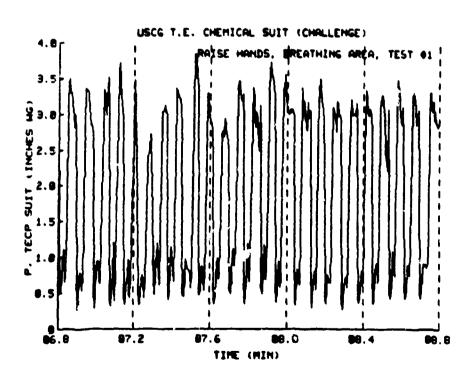
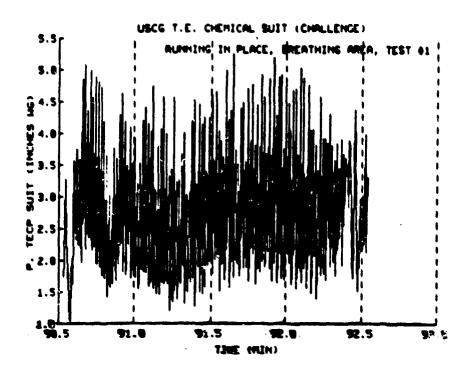


Figure 3. Internal TECP suit pressure for standing in place and rasing the hands above the head.



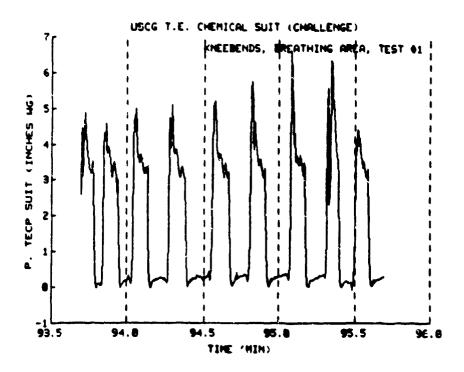
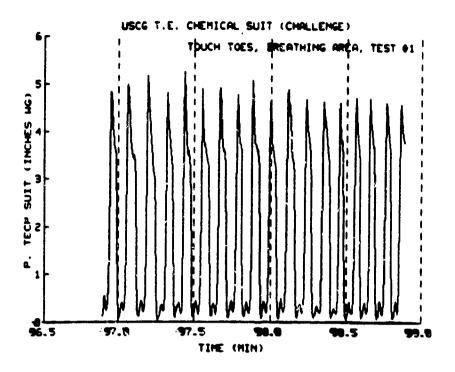


Figure 4. Internal TECP suit pressure for running in place and during kneebends.



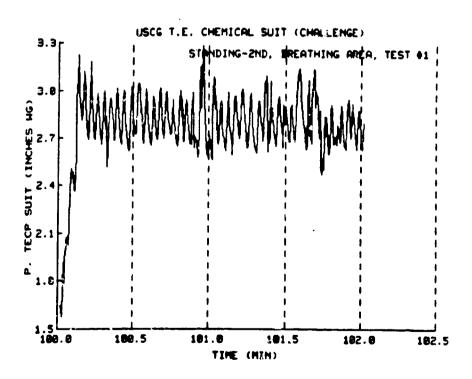
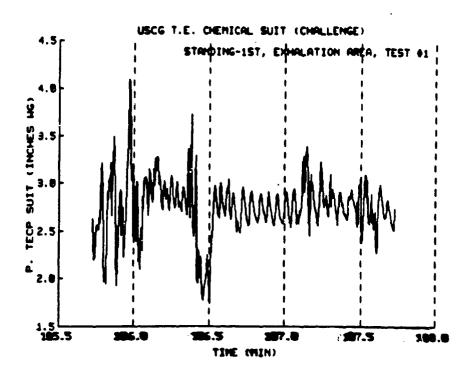


Figure 5. Internal TECP suit pressure for touching the toes and standing in place.



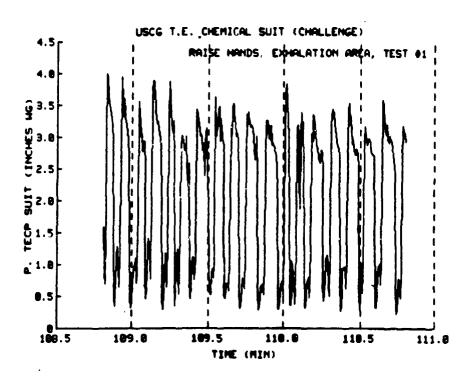
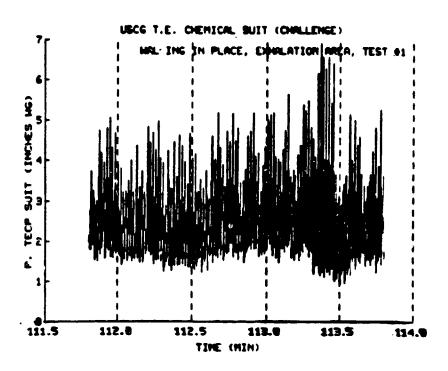


Figure 6. Internal TECP suit pressure for standing in place and rasing the hands above the head.



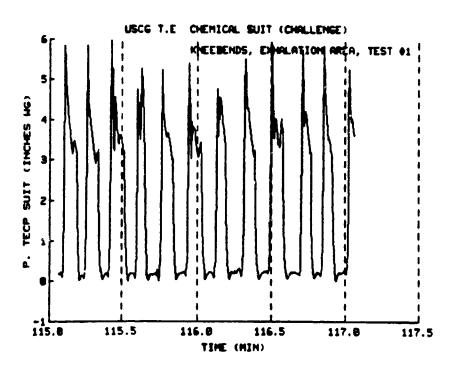
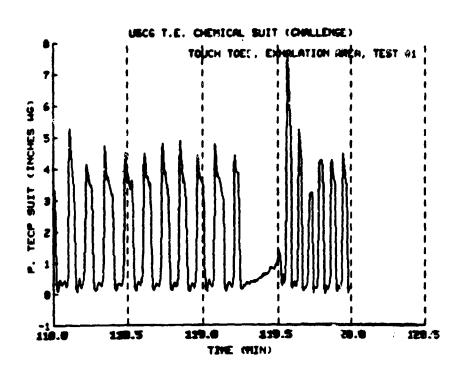


Figure 7. Internal TECP suit pressure for walking in place and during kneebends.



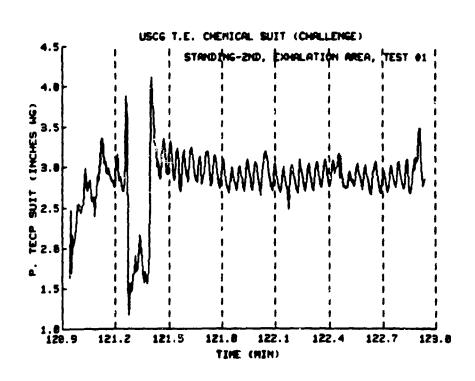
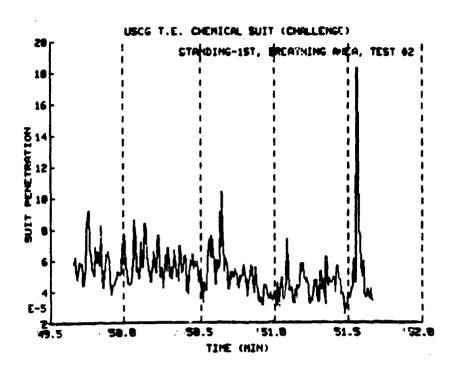


Figure 8. Internal TECP suit pressure for touching the toes and standing in place.



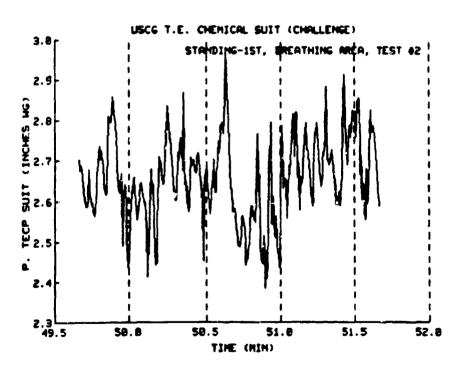
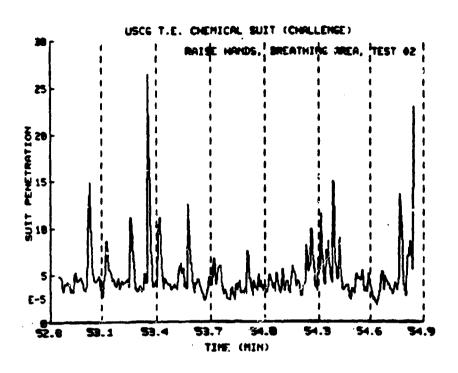


Figure 9. TECP suit aerosol penetration (BZ) and pressure plots for standing in place.



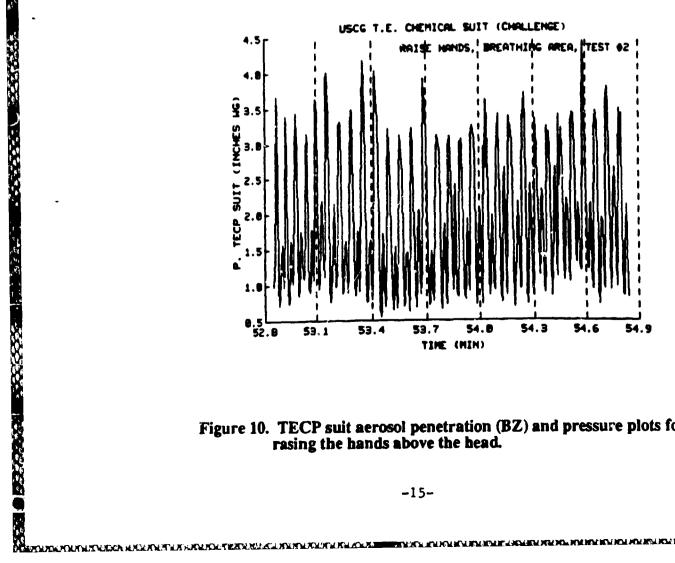
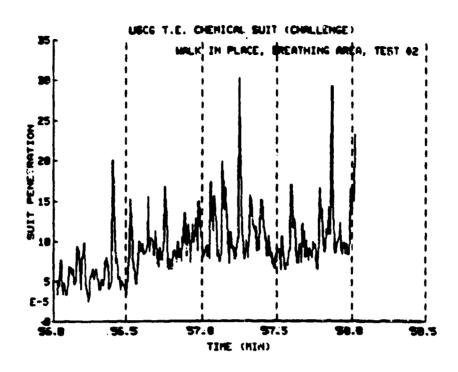


Figure 10. TECP suit aerosol penetration (BZ) and pressure plots for rasing the hands above the head.



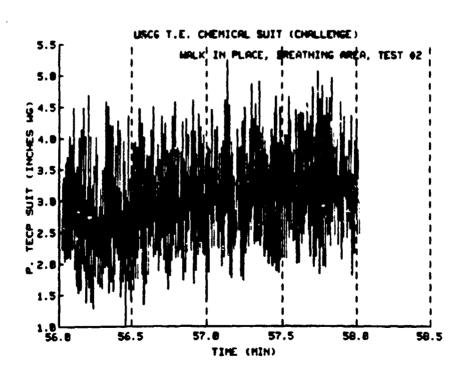
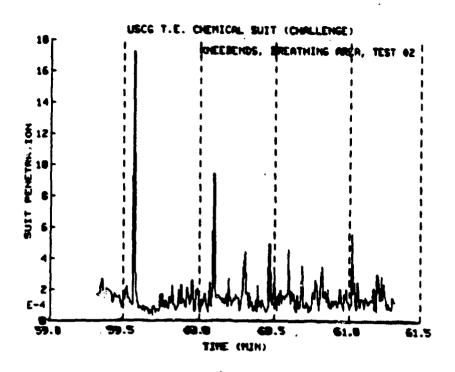


Figure 11. TECP suit aerosol penetration (BZ) and pressure plots for walking in place.



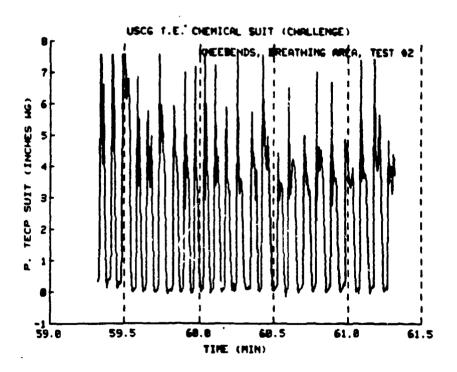
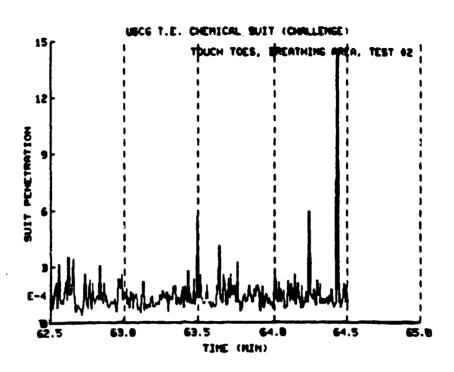


Figure 12. TECP suit aerosol penetration (BZ) and pressure plots during kneebends.



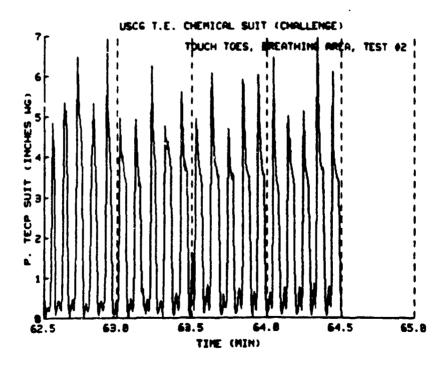
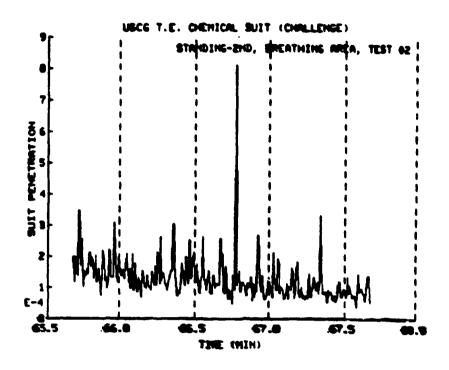


Figure 13. TECP suit aerosol penetration (BZ) and pressure plots for touching the toes.



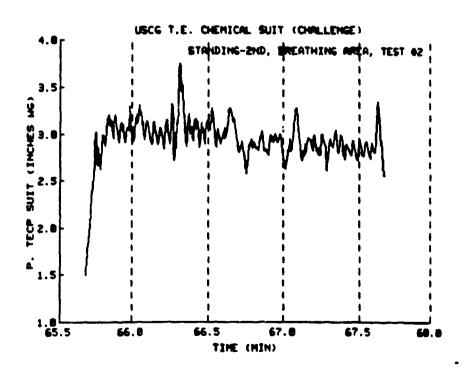
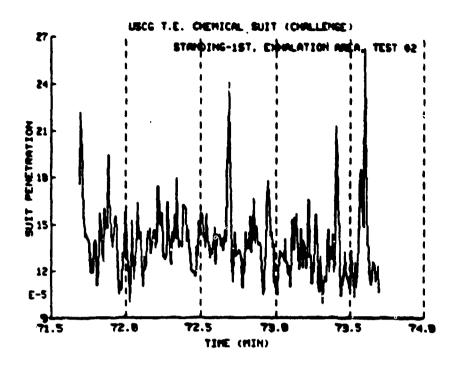


Figure 14. TECP suit aerosol penetration (BZ) and pressure plots for standing in place.



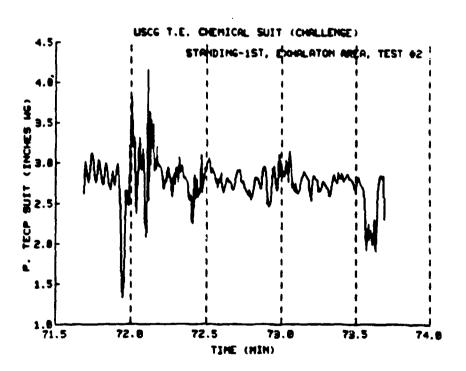
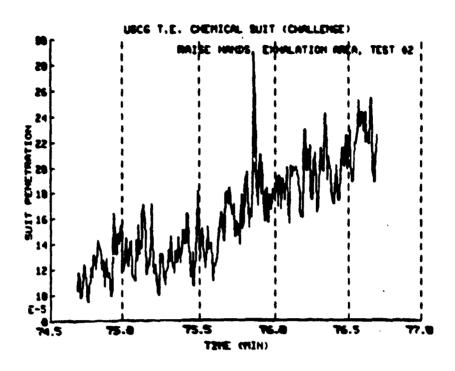


Figure 15. TECP suit aerosol penetration (VVZ) and pressure plots for standing in place.



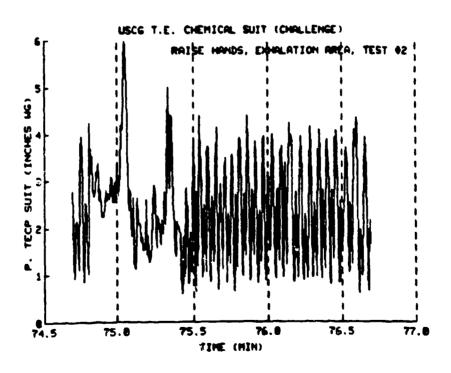
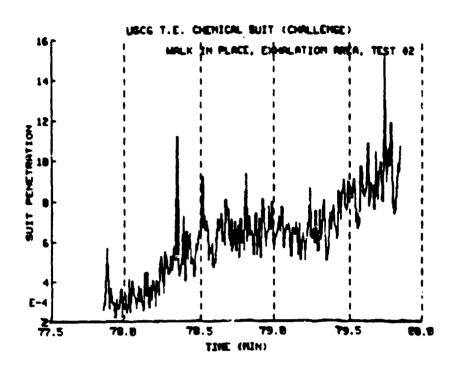


Figure 16. TECP suit aerosol penetration (VVZ) and pressure plots for rasing the hands above the head.



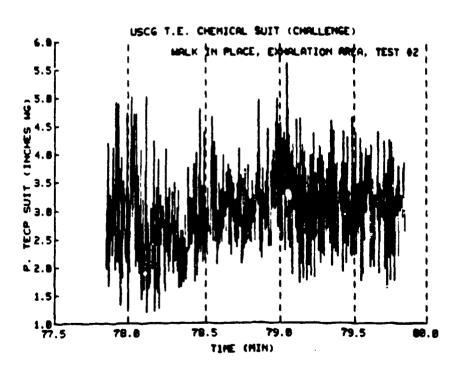
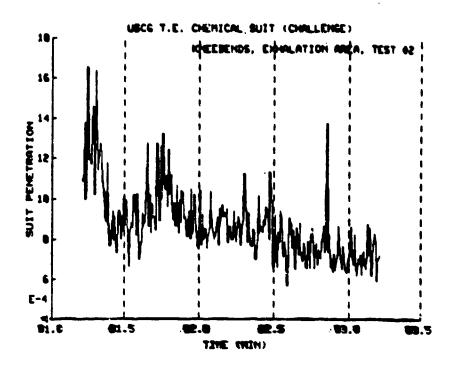


Figure 17. TECP suit aerosol penetration (VVZ) and pressure plots for walking in place.



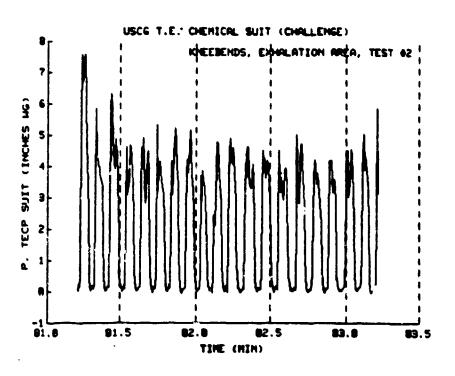
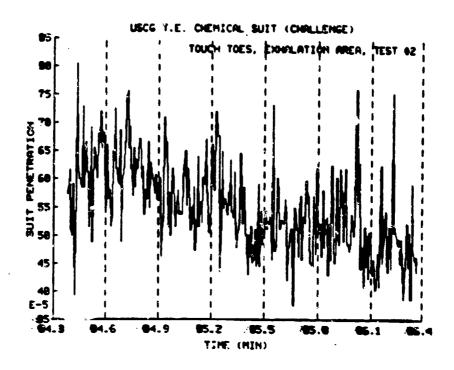


Figure 18. TECP suit aerosol penetration (VVZ) and pressure plots during kneebends



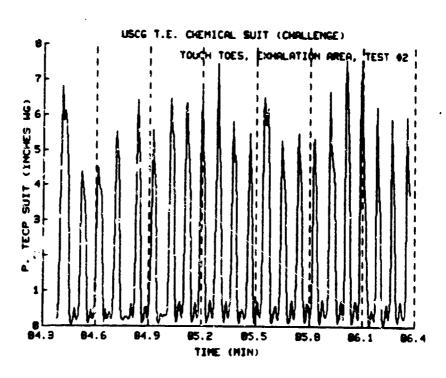
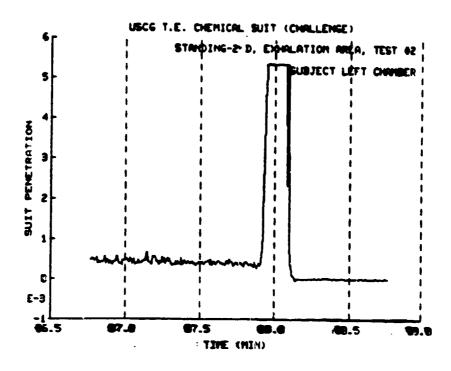


Figure 19. TECP suit aerosol penetration (VVZ) and pressure plots for touching the toes.



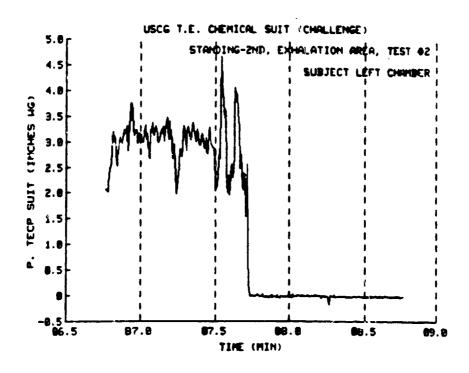
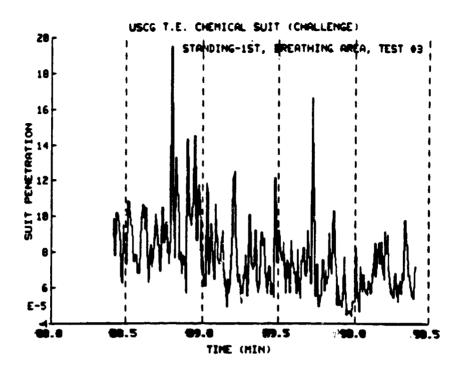


Figure 20. TECP suit aerosol penetration (VVZ) and pressure plots for standing in place.



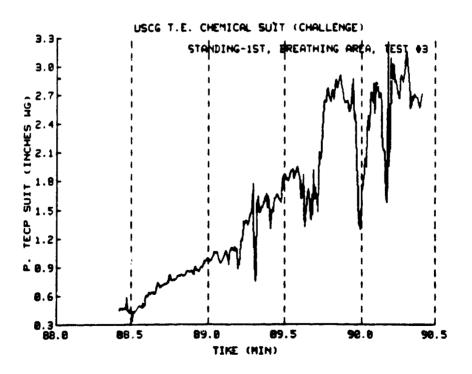
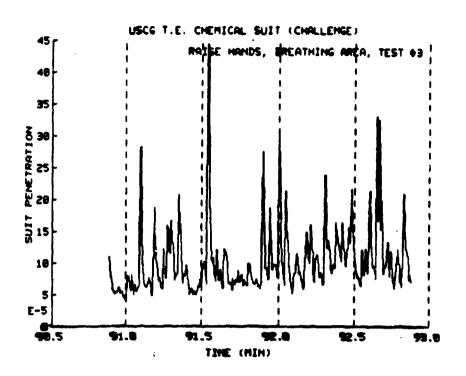


Figure 21. TECP suit aerosol penetration (BZ) and pressure plots for standing in place.



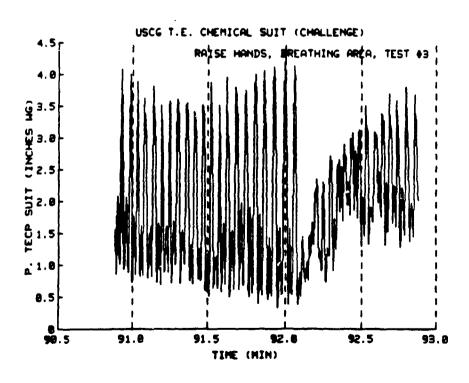
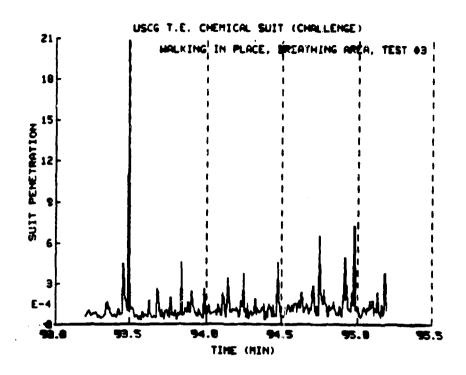


Figure 22. TECP suit aerosol penetration (BZ) and pressure plots for rasing the hands above the head.



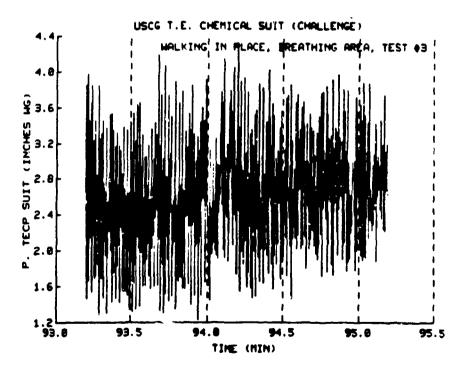
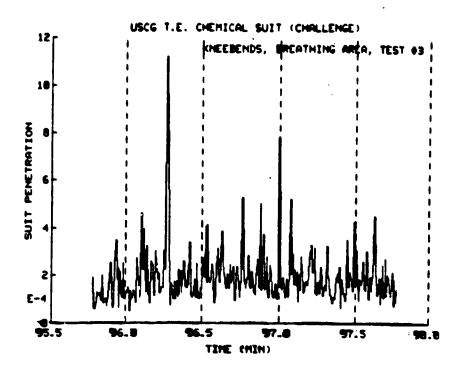


Figure 23. TECP suit aerosol penetration (BZ) and pressure plots for walking in place.

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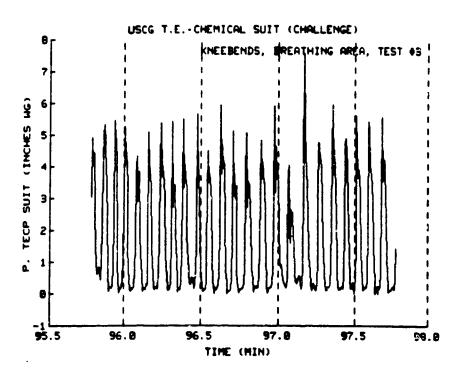
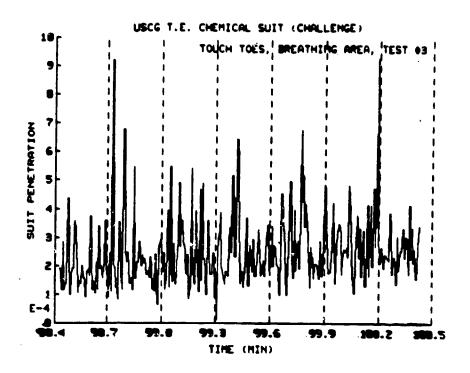


Figure 24. TECP suit aerosol penetration (BZ) and pressure plots during kneepends.



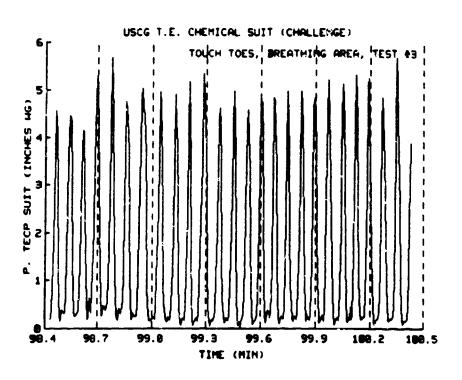
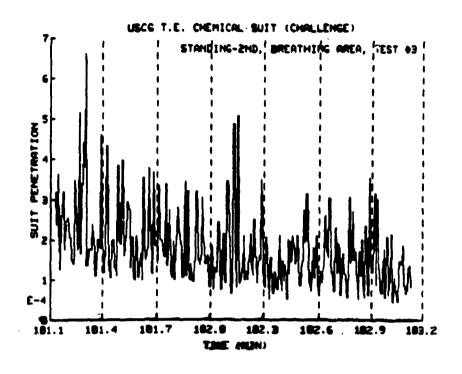


Figure 25. TECP suit aerosol penetration (BZ) and pressure plots for touching the toes.



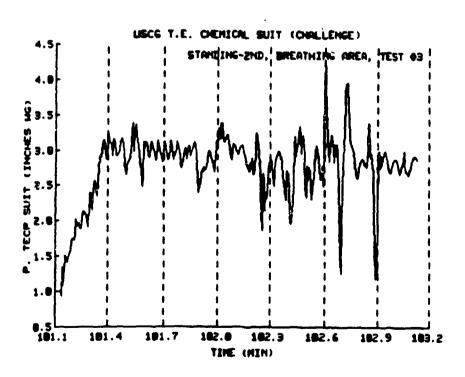
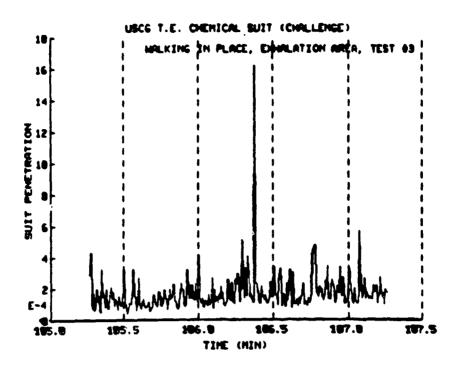


Figure 26. TECP suit aerosol penetration (BZ) and pressure plots for standing in place.



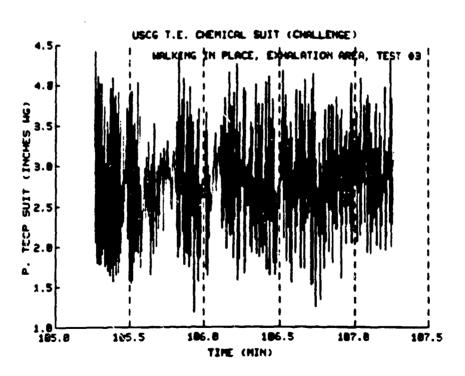
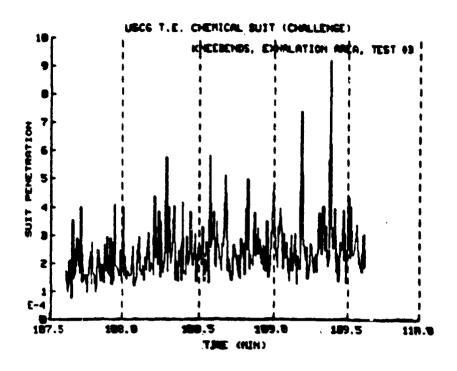


Figure 27. TECP suit aerosol penetration (VVZ) and pressure plots for walking in place.



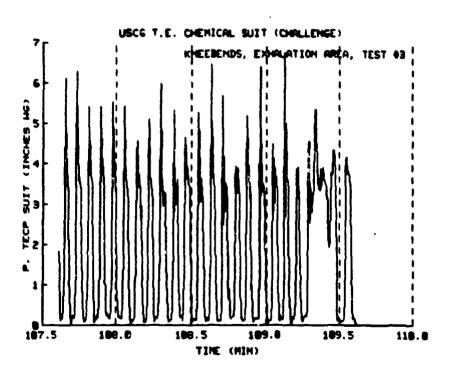
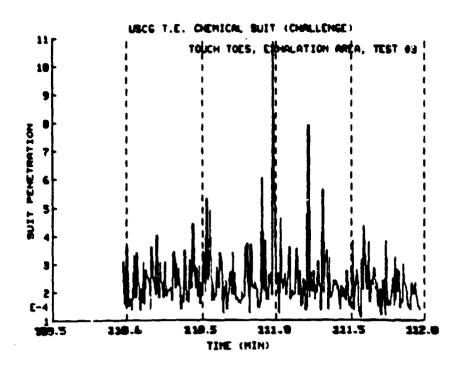


Figure 28. TECP suit aerosol penetration (VVZ) and pressure plots during kneebends



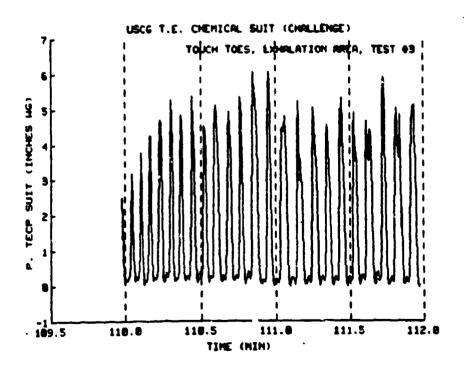


Figure 29. TECP suit aerosol penetration (VVZ) and pressure plots for touching the toes.

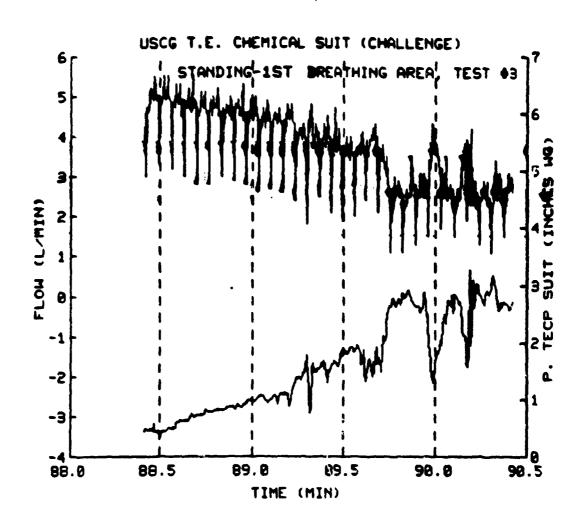


Figure 30. TECP suit pressure and flow plots for standing in place.

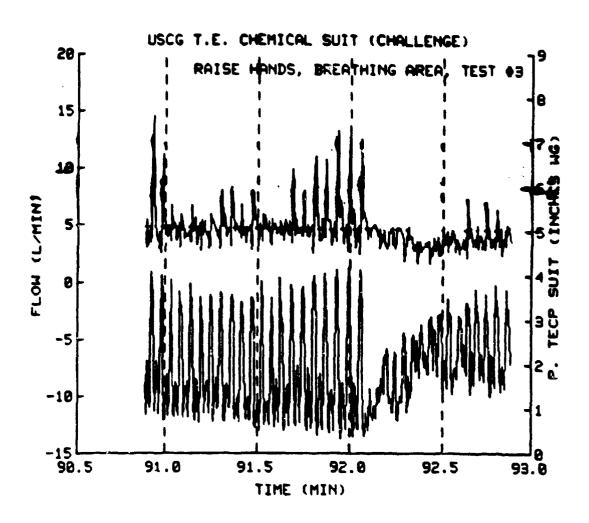


Figure 31. TECP suit pressure and flow plots for raising the hands.

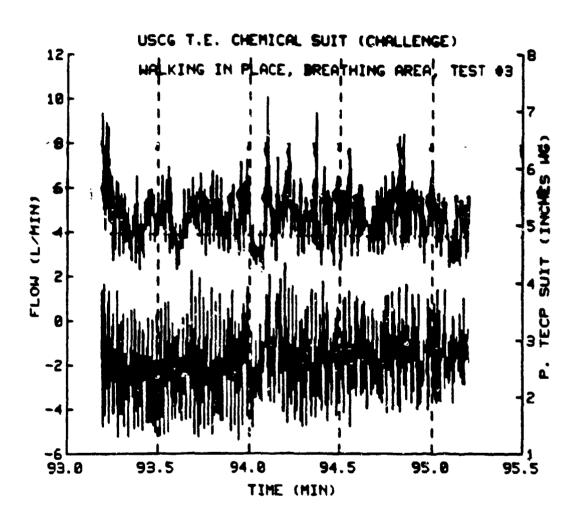


Figure 32. TECP suit pressure and flow plots for walking in place.

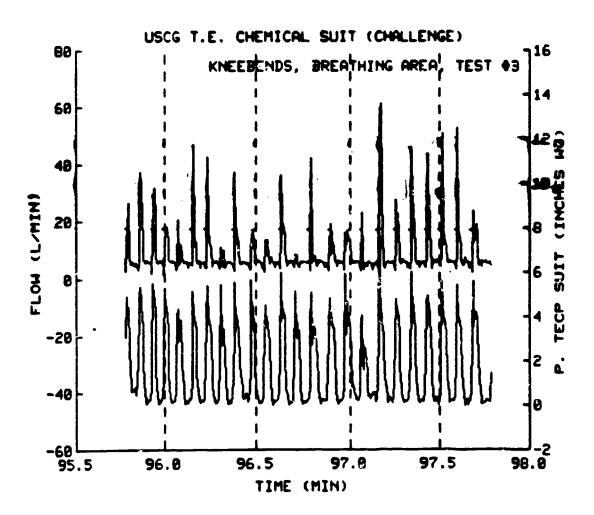


Figure 33. TECP suit pressure and flow plots during kneebends.

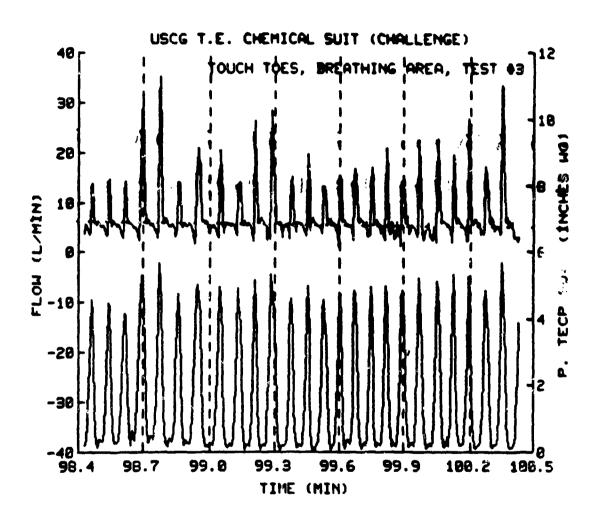


Figure 34. TECP suit pressure and flow plots for touching the toes.

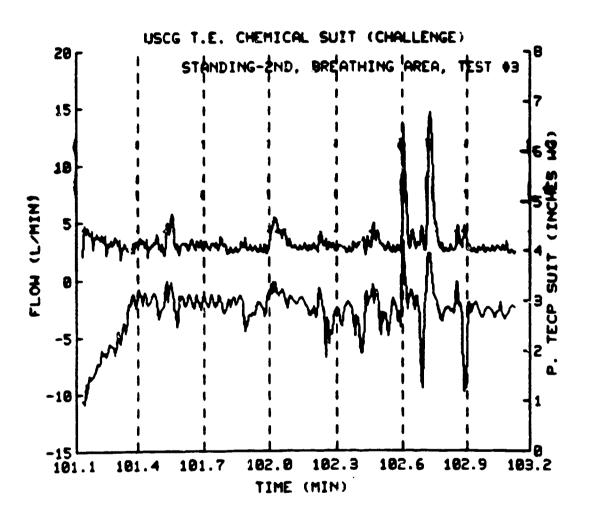


Figure 35. TECP suit pressure and flow plots standing in place.

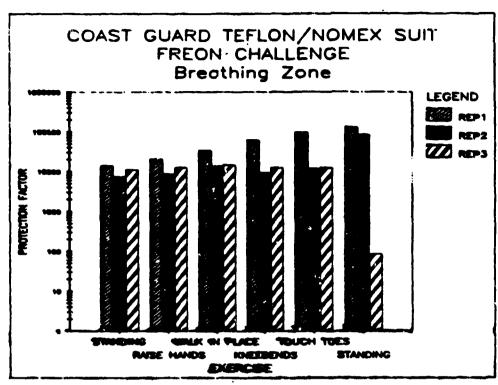


Figure 36. Bar chart showing achieved protection factors for various exercises while wearing the Coast Guard's Teflon<sup>R</sup>/Nomex TECP suit and sampling in the breathing zone for Freon<sup>R</sup>.

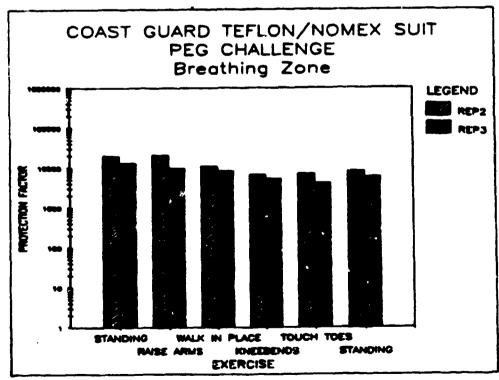


Figure 37. Bar chart showing achieved protection factors for various exercises while wearing the Coast Guard's Teffon R/Nomex R TECP suit and sampling in the breathing zone for PEG 400.

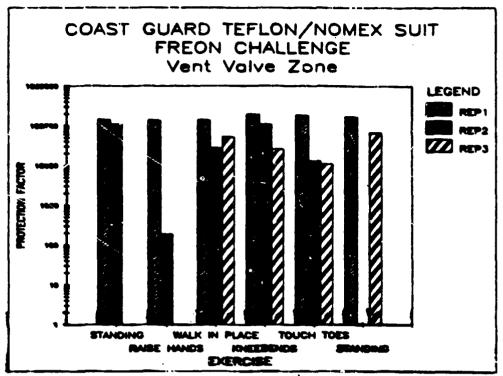


Figure 38. Bar chart showing achieved protection factors for various exercises while wearing the Coast Guard's Teffon R/Nomex TECP suit and sampling at the vent valve zone for Freon R.

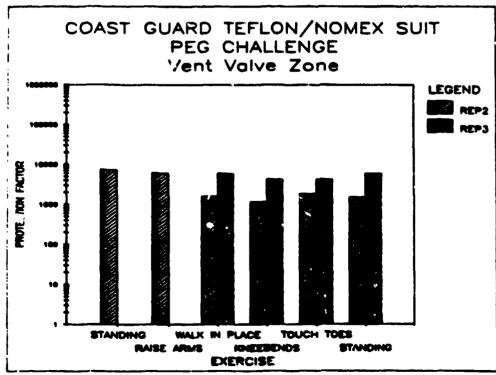


Figure 39. Bar chart showing achieved protection factors for various exercises while wearing the Coast Guard's Teflon R/Nomex R TECP suit and sampling at the vent valve zone for PEG 400.

Table 1. Approximate internal suit pressure variation (positive inches water gauge) during man tests.

	Test 1		Test 2		Test 3	
	min	max	min	max	min	max
Standing	1.9	3,4	2.4	3.0	0.3	3.3
Raise hands	0.25	3.8	0.5	4.5	0.5	4.2
Walking in place	1.0	5.3	1.0	5.3	1.2	4.3
Knee bends	0.1	6.8	0.1	7.5	0.1	7.6
Touch toes	0.1	5.3	0.1	5.9	D. 1	5.8
Standing	2.5	3.3	2.7	3.7	1.3	4.2
Standing	1.8	4.2	1.4	4.1	Not taken	
Raise hands	0.3	4.0	0.6	6.0	Not taken	
Walking in place	1.0	7.0	1.2	5.7	1.2	4.4
Knee bends	0.1	6.0	0.1	7.5	0.1	6.8
Touch toes	0.1	7.8	0.1	7.6	0.1	6.0
Standing	1.2	4.2	2.0	4.7	1.9	4.1
lowest min	(+) 0.1		(+) 0.1		(+) 0.1	
highest max	(+) 7.8		(+) 7.6		(+) 7.6	

## Discussion

The actual leak rate of TECP suits has not been measured accurately in hazardous material accidents. This lack of monitoring data is mainly due to the complicated nature of most accidents along with their unknown schedule. To obtain a reasonable estimate of TECP suit performance in "HazMat" operations a laboratory experiment has been designed to measure simulated TECP suit intrusion coefficients of the Coast Guard's new Teflon<sup>R</sup>-coated Nomex<sup>R</sup> suit. A man-test chamber equipped with both aerosol and gas leak-rate monitoring equipment was used. A series of light exercises designed to stress the various parts of the TECP suit was followed. The pressure inside the TECP suit was monitored continuously during the various exercises. The venting flow rate was also measured during one of the test runs.

Until this evaluation, there has been no information available describing the variation in internal pressure and venting flow rate of a TECP suit during actual use. Table 1 summarizes the various pressure extremes in the suit. They range from + 0.1 to + 7.8 inches w.g. This indicates that the positive pressure vent valves do function as planned. The restrictions to movement due to suit tightness from being pressurized was found to be acceptable. The actual value of the positive pressure however, at reducing leak rates into the suit, is still unproven. This information was also useful background information for establishing the inflation pressures of ASTM's "Standard Practice for Pressure Testing of Gas Tight Totally Encapsulating Chemical Protective Suits" (ASTM F 1052). It also provides a measure of the minimum strength suit materials, seams, and components must have. The venting flow rate, on the other hand, provides an accurate measure of the volume of air vented from the suit during the various exercises.

If one examines the plot of TECP suit pressure vs time for standing in place in Figs. 3, 5, 6, and 8, a measure of the positive pressure vent valve performance can be obtained. An eyeball average of the peaks produces an average cracking pressure of between 2.8 to 3.0 inches w.g. The pattern is somewhat irregular because it is dependent on the breathing patterns of the human subject and body movements which depress the suit volume. The pressure plot for standing in place in Fig. 8 however, illustrates the relatively small operational range under which the valves can open and close (AP approximately 1/2 inch w.g.). Since there were three vent valves in the suit during this test series, one cannot identify pressure variations due to individual valve cracking pressure differences. It can be said qualitatively from the vent valve sounds that only one valve was venting most of the time, especially during the standing in place exercise. The need for more than one valve is also questionable from this observation and the corresponding pressure traces. The ability of the Stratotech one-way vent valve to operate at a adjusted cracking pressure of 2 inches w.g. is also questionable due to the 2.8 to 3.0 inches w.g. operational range which was observed throughout this experiment.

By comparing aerosol suit penetration vs time to the pressure variation vs time, a measure of the effect of suit leakage to pressure variation can be obtained. A careful review of Figs. 9 - 14 and 21 - 26 where aerosol penetration in the breathing zone vs time is compared to internal suit pressure vs time does not produce an obvious relationship. The lack of pressure vs leak rate relationship for the vent valve zone (VVZ) in Figs. 15 - 20 and 27 - 29 can also be seen. Additional experiments will have to be made on a more detailed basis before this relationship can be completely understood.

In Figs. 36 and 37 the average protection factors for the various exerci es are illustrated as measured by Freon<sup>R</sup> 12 and PE6 penetration in the breathing zone area of the suit. There is a minimum of variability between the two methods in this sampling area. This is indicative of good mixing of the challenge agents before they reach the sensors and general agreement with reference to the existence and magnitude of the TECP suit leaks. Since the Freon monitoring system uses grab samples to analyze, it can be expected to miss leak rate peaks, especially if they are short in duration.

The PEG monitoring system operates on a continuous basis and gives a better measure of the overall suit leak rate. The large variability between the protection factors as measured by Freon<sup>R</sup> 12 and PEG are therefore understandable if the challenge agent occurs in pulses which are not mixed well. Thus, a more accurate measurement of VVZ leakage is provided by the PEG system which indicates the possibility of a significant leak from the vent valves. A more detailed evaluation of the leak rate of vent valves will be needed to determine if they present a significant leak source as they are used in the new Coast Guard TECP suit. This evaluation should examine valve performance during actual suit use and valve performance utilizing a laboratory test fixture.

## Conclusion

A series of test exercises have been carried out wearing the new U.S. Coast Guard's Teflon<sup>R</sup>-coated Nomex<sup>R</sup> totally-encapsulating chemical protective (TECP) suit. The leak rate of this new TECP suit was measured using both an aerosol (PEG 400) and gas (Freon<sup>R</sup> 12) during a prescribed series of test exercises. The internal suit pressure was also monitored and found to range from 0.1 to 7.8 inches of water gauge during the entire exercise series. This indicates that the positive pressure vent valves do function as planned, and keep the TaCP suit positive. The need for more than one vent valve should be examined more closely since it appeared that only one valve was operating in an effective mammer during the three tests. Protection factor/intrusion coefficient valves for PEG 400 and Freon 2 12 within the breathing zone area of the TECP suit were found to agree generally. Larger variations between the two challenge agents were found in the vent valve zone. This may be indicative of back streaming through the vent valves as venting takes place to relieve internal suit pressure. Additional studies which measure challenge concentrations inside the suit at various sampling locations are necessary to better quantify this preliminary observation. Laboratory experiments measuring the leak rates of TECP suit vent valves in an isolation test fixture are also necessary to better understand valve performance.

## APPENDIX L

EVALUATION OF SUIT INTEGRITY BY FIELD EXPOSURE TO HYDROGEN FLUORIDE VAPOR

(Report by Lawrence Livermore National Laboratory)



HYDROGEN FLUORIDE TESTING OF

THE U. S. COAST GUARD'S

TOTALLY-RECAPSULATING

CHEMICAL PROTECTIVE SUIT

## Safety Science Group

# Special Projects Division

Hazards Control Department

**Lawrence Livermore National Laboratory** 

#### HYDROGEN FLUORIDE EXPOSURE TESTING OF

#### U.S. COAST GUARD'S TOTALLY-ENCAPSULATING CHEMICAL PROTECTIVE SUIT

ABSTRACT: The U. S. Coast Guard Chemical Response Suit was field tested at the Department of Energy's Nevada Test Site in controlled releases of hydrogen fluoride. Two suits were placed on specially designed mannequins in two separate tests and subjected to hydrogen fluoride vapor concentrations up to 12,000 ppm for a 6 minute period. The mannequins contained a pulsed breathing air supply to simulate normal operation of the suit's exhaust valves and four different hydrogen fluoride detection systems. The analytical results of the two tests indicated no penetration of hydrogen fluoride into the suit.

KEYWORDS: Totally-encapsulated chemical protective suit, Fluoropolymer

Materials, Overall Protective Suit Testing, Suit Integrity, Hydrogen Fluoride

#### INTRODUCTION:

The U.S. Coast Guard has developed a new totally-encapsulated chemical protective suit for protection of personnel during chemical spill response. This suit involves a novel fluor polymer (Teflon)/aramid composite material which has demonstrated a high level of chemical resistance relative to existing commercial protective materials. Most of the suit's exterior components and materials have been evaluated for chemical resistance. 

Furthermore, the overall physical integrity of the Chemical Response Suit has been assessed using several different methods. 

However, the ability of the

entire suit to maintain its chemical resistance integrity during realistic field exposure conditions has not been tested. Documented evidence from suit failures in a dimethyl amine accident at Benicia, California demonstrate that chemical protective suit components can fail, exposing the wearer to hazardous chemicals. 3

The U. S. Department of Energy has constructed a large-scale spill test facility for liquified gaseous fuels and other hazardous materials in the Frenchman Flat Basin on the Nevada Test Site. The Lawrence Livermore National Laboratory (LLNL) assists the Department of Energy with the operation of this facility which provides data for public safety by studying the controlled spills of hazardous substances. In 1983, large scale releases of ammonia and mitrogen tetroxide were carried out to measure the atmospheric dispersion of the spilled chemicals. In the summer of 1986, releases of hydrogen fluoride and liquified petroleum gas of similar magnitude were conducted Proposed future activities at the spill facility will involve chlorine and other gases.

The U. S. Coast Guard funded the Safety Science Group of Lawrence
Livermore National Laboratory to carry out a small experiment to evaluate the
chemical protection of their new Chemical Response Suit in high concentrations
of highly corrosive hydrogen fluoride. This evaluation was done as part of
the hydrogen fluoride spill series sponsored independently by AMOCO
Corporation to develop and test atmospheric dispersion models. This spill
test series afforded the Coast Guard and Lawrence Livermore National
Laboratory the opportunity to determine if the new Chemical Response Suit
provided protection against high vapor concentrations of hydrogen fluoride.
The tests also assessed the feasibility of using high concentrations of
hazardous materials to test the performance of chemical protective clothing.

#### EXPERIMENTAL

Coast Guard Chemical Response Suit. Two different Coast Guard Chemical Response Suits were tested in separate hydrogen fluoride spills. The Chemical Response Suit is a totally-encapsulating chemical protective suit developed to provide a high level of protection in chemical spill response. This suit is designed to fully enclose both the wearer and his or her breathing apparatus (Figure 1). Features of this suit include a full body garment with a hood and visor, internal positive pressure operation, a gas-tight zipper, and integral gloves and boots. The suit uses fluorop; iymer based materials for the garment, visor, and gloves; non-fluoropolymer components include the suit zipper and exhaust valves. Only the garment material has been tested against hydrogen fluoride in laboratory testing and showed no permeation in a three hour period. 5 The suit exhaust valves are protected by an inverted pocket to reduce the likelihood of direct contact with chemical splashes. The suit closure is protected by a cofferdam arrangement with two flaps of garment material which are temporarily heat-sealed over the zipper (Figure 2). Positive pressure is achieved within the suit by the exhaust air from a self-contained breathing apparatus. This exhaust air is vented through suit exhaust valves adjusted to maintain an internal suit pressure of 3.8 mm Hg (2.0 inches water).

Suit Mannequin and Instrumentation Package. A mannequin was constructed out of wood to both support the Chemical Response Suit in an upright position and house the instrumentation package (see Figure 3). Figure 4 shows the relative position of equipment on the mannequin. The instrumentation package included analytical devices to measure hydrogen fluoride intrusion, and an air supply system to keep the suit inflated and cool during the experiment. Four

separate techniques were used to measure hydrogen fluoride vapor concentrations with the suits. The reason for a four-fold analytical system was to provide redundancy that would assure data collection even if one or more of the individual analytical devices failed. Two techniques were recommended by AMOCO; these included the AMOCO Integrated Field Sampler (IFS) and the GMD Systems AUTOSTEP Model 930 Portable Monitor. Both of these devices were used by the AMOCO spill site team to analyze hydrogen fluoride concentrations in the spill zone. Two other techniques were added by the Safety Science Group to provide additional analytical information: the Sensidyne SS2000 portable HF monitor and silica gel sorbent tubes. The characteristics of each analytical devices are described below.

AMOCO Integrated Field Sampler. The AMOCO IFS is a proprietary air sampling device. The instrument sequentially pulls air through each of 10 commercial Air-Sampling Field Monitors (Pisher Scientific: Gelman 4339 styrene filter holder, PN 01-038; Gelman MetricelR membrane filters, Grade CN-4, PN 09-730-47). The field monitors contain membrane filters pretreated with a proprietary method specific for retention of hydrogen fluoride. The flow volume through each cassette was precalibrated with an AMOCO data logger designed for used with the IFS. The time of flow through the cassettes is adjustable on a group basis, however, once a time interval is selected, every cassette in the series uses the same one. The interval used during this study was 66.6 seconds. Following use of the IFS, the cassettes were removed and each membrane was analyzed for HF content by use of ion selective electrodes. The measured detection limit for HF vapor was 0.03 ppm. The specific time hydrogen fluoride was first detected is indicated by the number of the cassette which first showed a measurable content.

GMD Systems AUTOSTEP Monitor. This system uses a colorimetric principle

in an automatic incremental mode. Color producing chemicals specific for hydrogen fluoride are impregnated into a paper tape that is stored in a removable cassette. A pump pulls a calibrated air volume sample of the test atmosphere through the tape. The tape is monitored by a L.E.D. photodiode combination which translates color intensity into a readout. After a programmed interval, the tape is stepped forward and the next sample is taken. At the start of each measuring sequence, a reading is taken of the tape background color intensity, which is stored in memory, and then subtracted from the reading at the end of the sampling interval. The analogoutput from the AUTOSTEP monitor was sent to a chart recorder within the instrumentation package and also transmitted by field wire to a telemetry station. During each of the suit tests, the instrument was operated in the G-30 ppm, range. The detection limit calibrated for the specific paper taped used was nominally 3 ppm.

Sensidyne SS2000 Portable Toxic Monitor. This device uses an amperometric electrochemial sensor and responds to concentrations of analyte that diffuse across a semipermeable membrane. Calibration of the instrument indicated a repeatable linear response for hydrogen fluoride with a detection limit of 0.4 ppm, and usable upper range to 10 ppm,. Sensor response was found to be within the 10 seconds specified by the manufacturer. During this project, an analog output from the Sensidyne was continuously monitored by telemetry in the control room. The signal was also monitored by a strip chart recorder within the suit instrumentation package.

Silica Gel Sorbent Tubes. Four separate SKC, Inc. (Cat. No. 226-10-03) sorbent tubes, two on each side of the mannequin, were used during the tests. A Gillian sampling pump drew air through the tubes at a calibrated flow rate for each tube of 0.2 liters/minute. Subsequent to the collection period, the

tubes were desorbed with eluant solution and analyzed for fluoride by ion chromatography. The measured instrumental detection limit was 1.0 ug. With a controlled flow period of 10 minutes, the hydrogen fluoride vapor concentration would have to exceed 0.6 ppm on a continuous basis to be measured.

Suit Pressurization and Cooling System. Since these experiments were conducted under the high temperature conditions of the desert, the suit was cooled before and after the experiment to protect the instrumentation package inside the suit. A second requirement was to simulate the operation of a self-contained breathing apparatus inside the suit. First, the cooling was achieved by an air flow from four cylinders of compressed air plumbed together in series underground near the suit. Then, the breathing simulation requirement was met by using remotely operated standard sized (2700 psi) breathing air cylinders inside the suit. Figure 5 shows a sch-matic of the control system for the analytical instruments and air supply (The entire experimental set-up is illustrated in Figure 6). When the experiment began, the cooling air was shut off, while internal suit cylinder air was pulsed periodically for the duration of the experiment. At the end of the experiment, the interior cylinder was shut off, and the exterior cylinders reopened to provide cooling air and to flush the interior of the suit.

Exposure Conditions. The facility's experimental test plan outlined a series of four hydrogen fluoride spills at different release rates and humidity conditions. Lawrence Livermore chose the two exposure conditions where 1000 gallons of hydrogen fluoride were released over a 6 minute period to separately expose the Coast Guard's Chemical Response Suits. One suit exposure was conducted under ambient humidity conditions. The second suit was exposed to the hydrogen fluoride under more humid conditions. Local lake bed

flooding and a humidity generation apparatus were used to artificially humidify the environment. However, the overall effect on relative humidity was small. The suited mannequin was placed near a spill zone instrument tower located approximately 300 meters directly downwind from the chemical release point. This location offered the nearest site to the acid spill nozzle which had hydrogen fluoride monitoring equipment in place, was adjacent to a photographic tower for film recording, and had access to a telemetry station for data transmission. Data from the instrument tower were used to measure the exterior exposure of hydrogen fluoride received by the suit. The actual exposure conditions to which each suit was subjected are given in Table 1.

Procedure. The suit mannequin assembly was placed on a suspension stand at the exposure site (Figure 7). Following the release of the hydrogen fluoride, an operator in the Test Facility control room activated the interior suit sampling equipment before the cloud reached the suit. This sampling was continued until the hydrogen fluoride cloud dissipated. Once the test director determined the site safe for entry, a two-person retrieval team decontaminated the suit and related hardware with a dilute ammonia washdown, followed by a water washdown. The effectiveness of this decontamination technique was verified by checking the wetted surfaces with pH paper for trace acidity. The exterior of the suit was then inspected before the mannequin was disassembled. Interior suit samplers were collected and sent off for analysis.

#### RESULTS AND DISCUSSION

Table 2 shows that only the AMOCO IFS detected any hydrogen fluoride.

This instrument has the lowest detection limit and the amounts indicated are close to that limit. There are two reasons which mitigate against these data

indicating a real concentration of HF inside the suit. The first reason is that the cassettes in the first two positions (first 2.2 minutes of experiment) showed some small quantities of acid as di'those in the later positions (last 2.2 minutes of experiment). This indicates a high 'blank' (zero) value because there was no hydrogen fluoride vapor outside the suit at initial stage of the experiment. It is known that silica dust will give a false positive for HF on this method. At an average wind velocity of 3-5 meters/second, the cloud has insufficient time to move 300 meters downwind to the suit location. This observation was confirmed visually for each of the two wasts. The second reason against this date showing a suit lask, is the observation of IFS precision: measurements appear random throughout its overall operation tycle. For these reasons we feel that the values are so close to the detection limit that they are merely a 'blank' reading. If a worse case position was taken in that the values were true, the measure maximum concentration (0.20 ppm,) of hydrogen fluoride would still be well below the ACGIH TWA level (3 ppm ) or Short Term Exposure Limit (6 ppm\_). 6 This indicates that the protection offered by the suit is quite high.

The other three analytical techniques showed no measurable hydrogen fluoride at any time during the two field tests. The Sensidyne instrument had the second most sensitive detection limit and in each test, no measurable signal was generated (in the first test by telemetry, and in the second test by both telemetry and on the chart recorder). The consistency of this data supports our analysis of the IFS data as being variable within the analytical method. Our various monitoring data indicate that the suit maintained complete integrity against a very high external hydrogen fluoride vapor challenge.

#### CONCLUSIONS

Our experience with conducting field tests of chemical protective suits under controlled hazardous material spill conditions indicates the feasibility of performing this test for other protective garments and chemicals. These methods appear useful for determining the performance of protective clothing under actual exposure conditions. While it would be both time consuming and costly to test a garment against several chemicals, field tests of this type could be conducted on a smaller scale and under more controlled conditions to assess the usefulness of related laboratory garment material testing.

Furthermore, this technique offers a means to test the entire garment as used in the field.

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TABLE 1 - Test Hydrogen Fluoride Exposure Conditions

Test	1 (8/14/86)	Test	Test 2 (8/20/86)		
Time (min.)b	Concentrat 1 Meter <sup>C</sup>	ion (ppm) <sup>a</sup> 3 Meter	Time (min.)	Concentra 1 Meter	tion (ppm) 3 Meter
0.00	0	0	0.00	0	0
1.11	1400	950	1,10	8600	3400
2.22	20000	16000	2.20	12000	2500
3.33	18000	30000	3.30	13000	3900
4.44	6800	15000	4.40	17000	4100
5.55	<b>78</b> 00	8100	5.50	11000	3200
6.66	13000	0	6.60	13000	3800
7.77	300	22000	7.70	4200	2900
8.88	210	6200	8.80	960	1600
9. 9 <del>9</del>	0	0	9 <b>. 9</b> 0	270	133
			11.00	200	110
Maxique Conc. (Time)	20000 (2.2	2)/30000 (3.33	) . 17	7000(4.40)/4	100(4.40)
Average Conc.	12000	.•	90	000	
Test Relative Humidity	10-12%		16	-18%	

aHydrogen fluoride concentrations measured by AMOCO IFS. These concentrations represent the average of the integrated sample measurement over the sampling interval.

bThis time represents the end of sampling interval.

CSpill site tower concentrations were measured at a one meter and three meter height. The Chemical Response Suit was held upright at a height of 1.5 meters.

TABLE 2 - Summary of Hydrogen Fluoride Measurements Inside Chemical Response Suit

Detection Method	Detection Limit (ppm)	Test 1 Results (ppm)	Test 2 Results (ppm)
AMOCO IFS	0.03	High: 0.20 Low: 0.04 Avg.: 0.08	High: 0.10 Low: 0.03 <sup>a</sup> Avg.: 0.05
Sensidyne SS2000	0.2	ИДр	ИD
GMD Systems AUTOSTEP	3.0	ND	ND
Silica Gel Sorbent	0.6 <sup>c</sup>	ND	ИD

alow concentration below detection limit of analytical device

bND - no hydrogen fluoride detected by method

Cactual detection limit is 1 ug mass by ion chromatograph; effective detection limit is 0.6 ppm based on integrated sample over sampling interval

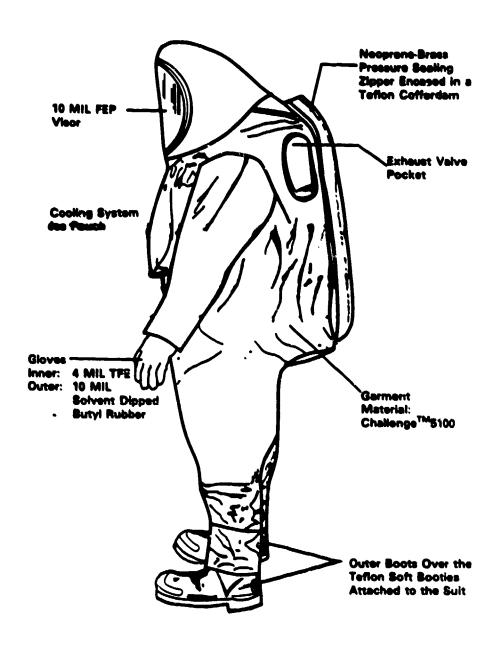
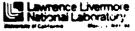


Figure 1. Coast Guard Chemical Response Suit



Figure 2. Heat Sealed Closure of Chemical Response Suit



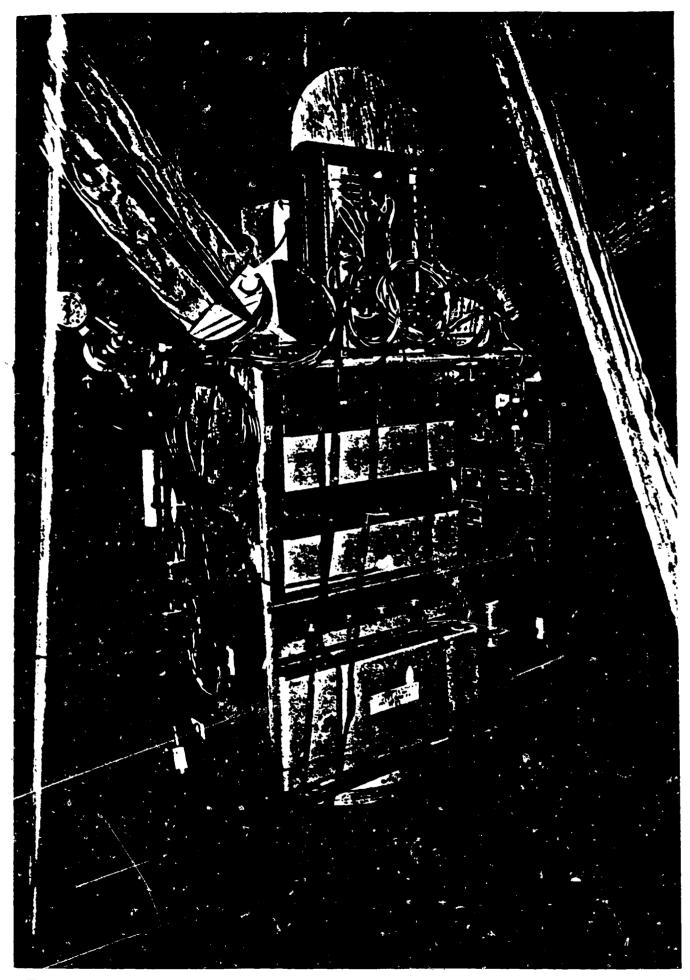


Figure 3. Photograph of instrumented test mannequin.

### Front View

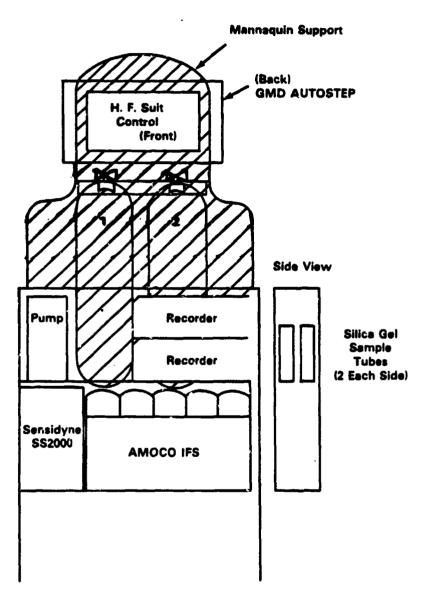


Figure 4. Diagram of Mannequin Equipment Layout

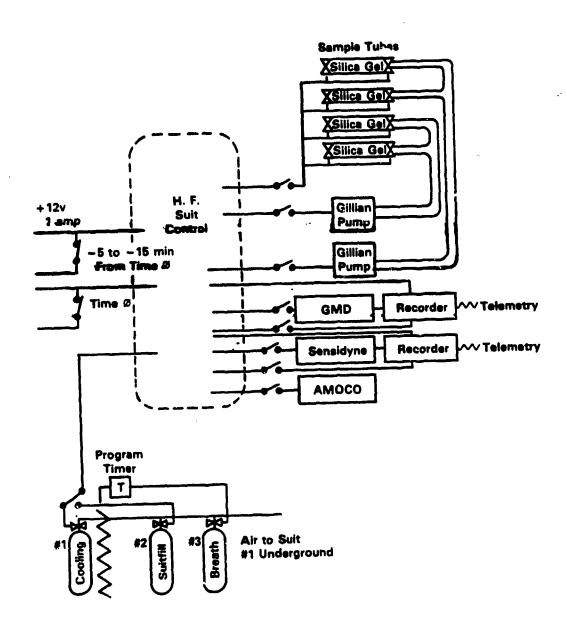


Figure 5. Suit Instrumentation Control Package

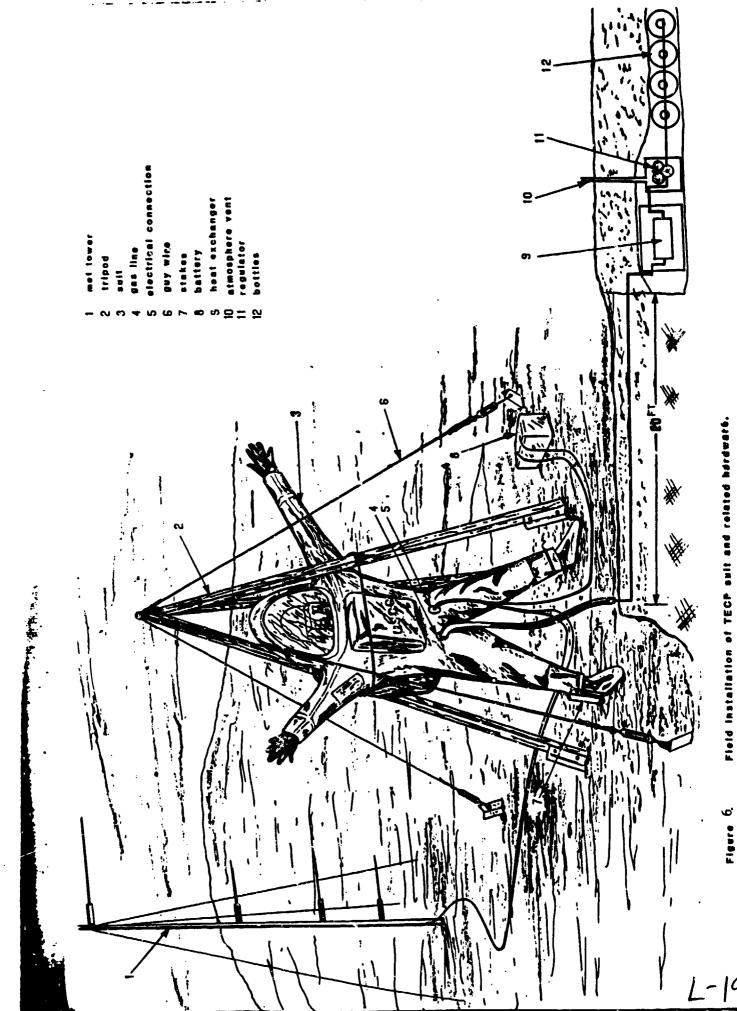




Figure 7. Inflated suit on suspension stand.